Carusiello, Chris

From: Schuknecht.Mark@epamail.epa.gov
Sent: Thursday, June 07, 2012 10:17 AM
To: Kinch.Richard@epamail.epa.gov
Subject: workgroup e-mails on Website work

[redacted]

[redacted]

Redaction
Exemption 5
Deliberative
Process

Mark Schuknecht.S. EPA
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Resource Conservation and Sustainability Division
Industrial Materials Reuse Branch
Scrap Tire Coordinator
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Richard Kinch---06/06/2012 01:40:27 PM---[redacted]

From: Richard Kinch/DC/USEPA/US
To: Mark Schuknecht/DC/USEPA/US@EPA
Date: 06/06/2012 01:40 PM
Subject: Re: Fw: [ScrapTire] Website Comment Peroid Ending [1 Attachment]

Redaction Exemption 5
Deliberative Process

[redacted]

Mark Schuknecht---06/06/2012 11:36:06 AM---[redacted]

From: Mark Schuknecht/DC/USEPA/US
To: Richard Kinch/DC/USEPA/US@EPA
Date: 06/06/2012 11:36 AM
Subject: Fw: [ScrapTire] Website Comment Peroid Ending [1 Attachment]

[redacted]

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----- Forwarded by Mark Schuknecht/DC/USEPA/US on 06/06/2012 11:26 AM -----

From: Mark Schuknecht/DC/USEPA/US@EPA
To: ScrapTire@yahoogroups.com, ahorsman@ontariots.ca, aohare@cement.org, Audrey.Copeland@dot.gov, Bob.doctor@wyo.gov, Boxing.Chenge@calrecycle.ca.gov, A bert.johnson@Calrecycle.ca.gov, blake.nelson@state.mn.us, burross.john@azdeq.gov, carey.hurlburt@ct.gov, charles.johnson@state.co.us, Choutchens@americantireexchange.com, Cfryer@sccommerce.com, Clint.Cook@deq.ok.gov, dan.fester@dnr.mo.gov, dana_humphrey@umit.maine.edu, DavidForr@aol.com, David.Snapp@state.co.us, dcarlson@l bertytire.com, denise@dkenterprises.us, EHOOVER@adeq.state.ar.us, fieldprograms@cvswmd.org, Fenton.Rood@deq.ok.gov, Ferrella.March@deq.ok.gov, Frank.espino@tceq.texas.gov, George.Gi bert@ky.gov, greg.hendrick@lafarge-na.com, harry.smail@epa.state.oh.us, Mary Hunt/R3/USEPA/US@EPA, Jason.Harrington@fhwa.dot.gov, JDosborn@hotmail.com, Jennifer.Pelloat@la.gov, jjasports@comcast.net, jgilbert@empire.state.ny.us, john.gowan@deq.ok.gov, Johnston.connelly@wisconsin.gov, JonathanLevy@isri.org, josieber@state.pa.us, Kendra.riffe@tceq.texas.gov, keri.meyers@la.gov, kfishman@buffalo.edu, Kole.kennedy@deq.ok.gov, kste461@ECY.wa.gov, Lauren.Oconnor@dep.state.fl.us, larry@polyvulcusa.com, MaryAnn Lafaire/R5/USEPA/US@EPA, LassiterConsulting@gmail.com, LindlerMA@dhec.sc.ov, lisa.evans@ky.gov, louis.bordenave@tn.gov, mary@scraptirenews.com, Mail@recycleARK.org, Mbelshe@rubberpavements.org, mbenoit@ckrc.org, McDanirs@dhec.sc.gov, michael@rma.org, KrausMc@dhec.sc.gov, mlewis@cablelynx.com, montemkn1@aol.com, Golam Mustafa/R6/USEPA/US@EPA, MOconnell@rirrc.org, Kendra Morrison/R8/USEPA/US@EPA, Mwinek@bccz.com, nicholas.boudreau@dphe.state.co.us, ChristopherM Newman/R5/USEPA/US@EPA, pamela.moore@ncdenr.gov, OYERR@michigan.gov, Rchiari13@gsb.columbia.edu, rbohn@utah.gov, Richard.Colyar@cmworks.com, Ricky.solomon@ky.gov, rick@syntheticturfcouncil.org, Shana.baker@state.co.us, Sally.French@calrecycle.ca.gov, Mark Schuknecht/DC/USEPA/US@EPA, ScottHorne@ISRI.org, Stacey.Patenaude@calrecycle.ca.gov, stillots@nd.gov, SteveD Smith/R4/USEPA/US@EPA, tagray@flash.net, tiregator@aol.com, Tim.Link@wyo.gov, Todd.Marvel@illinois.gov, toni.duggan@state.nm.us, tracey@rma.org, tewood@coopertire.com, twilson@cement.org, vonni.kallemeyn@state.sd.us, whitejm@dhec.sc.gov, wingar2@Clemson.edu, Winthrop_Brown@dnr.state.ga.us, wmhansen@Utah.gov, wrightwj@dhec.sc.gov, zicari@eng.buffalo.edu
Date: 04/30/2012 12:56 PM
Subject: [ScrapTire] Website Comment Peroid Ending [1 Attachment]
Sent by: ScrapTire@yahoogroups.com

[Attachment(s) from Mark Schuknecht included below]

The Comment Period will expire soon. Please send me your comments ASAP, so that I can develop a final version that will be submitted to EPA management and begin the approval process.

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Attachment(s) from Mark Schuknecht
1 of 1 File(s)
Master SCRAP TIRE WEBSITE UpDdate2.docx
Reply to sender | Reply to group | Reply via web post | Start a New Topic
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Wastes – Resource Conservation – Common Wastes & Materials – Scrap Tires

Scrap Tires

http://www.epa.gov/epawaste/conserve/materials/tires/index.htm

In 2009, approximately 291.8 million or 5,170.5 tons of scrap tires were generated in the United States. The rate of generation in 2009 was slightly below the historical average of one scrap tire generated per person per year. This reduction was due to the reduced sales of automobiles and replacement tires.

Markets now exist for about 84 percent of scrap tires. The states have played a major role in tackling this problem by regulating the hauling, collecting, processing, and storage of scrap tires, by working with industry to recycle and beneficially use scrap tires, and by developing markets. Since states began their scrap tire programs, the number of tires going to markets increased from 11 percent (in 1990) to today's level of 84 percent. Since 1990 the number of scrap tires in stockpiles has been reduced from about 900 million to 120 million.

This website provides general information on scrap tires, including:

- Basic Information - overview and statistics on scrap tire management and information about tire pile cleanups.
- Uses and Markets - overview of scrap tire markets. The four largest markets are described in additional detail:
    - Tire-Derived Fuel, and TDF Frequent Questions
    - Civil Engineering
    - Ground Rubber
    - Rubberized Asphalt
    - Other Applications
- Environmental Issues
- Laws/Statutes - State scrap tire legislation and programs
- Where You Live - links to state and EPA regional information
- Grants and Funding
- Science and Technology - innovative uses of scrap tires
- Publications
- Scrap Tire Workgroup - overview, goals and plans.
    - Goals Committee
    - Ground Rubber Committee
    - Civil Engineering Committee
    - Rubberized Asphalt Committee
    - TDF Committee

Commented [MRS1]: GR and RA links are reversed

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Basic Information

http://www.epa.gov/epawaste/conserve/materials/tires/basic.htm

Biennially, the Rubber Manufacturing Association working in conjunction with the EPA Scrap Tire Workgroup collects and publishes a report entitled Scrap Tire Markets in the United States Biennial Report that includes Scrap Tire Facts and Figures: 2009 and graphs from the U.S. Scrap Tire Management Summary 2005-2009.

In 2009, all uses for scrap tires consumed 4,391 tons of the 5,171 tons generated annually:

"Over 84.9 % of scrap tires are recycled or beneficially used for fuel or other applications."
- Rubber Manufacturers Association, 2011 (rma.org)

- 1,354.2 tons (26.8%) were converted into ground rubber and recycled into products.
- 284.9 tons (5.5%) were used in civil engineering projects that equals 10 million tires.
- 2,084.7 tons (40.3%) were used as fuel equaling approximately 88.65 million tires
- 175 million pounds were used in rubber-modified asphalt
- 102 tons (2.0%) were exported
- 1.9 tons were recycled into cut/stamped/punched products
- 7.1 tons (0.1%) were used in agricultural
- Between 13-15 million scrap truck tires were retreaded.

There are 175 scrap tire processing facilities in the US of which 119 were for Tire Derived Fuel, of which

- 47 are cement kilns
- 30 are pulp paper mills
- 22 are utility boilers
- 19 are industrial boilers
- 1 is a dedicated tire to energy facility

(Source: Scrap Tire Facts and Figures 2009 Rubber Manufacturers Association 2011)

TYPICAL TIRE COMPOSITION BY WEIGHT

Passenger tire	
Natural rubber	14 %
Synthetic rubber	27 %
Carbon black	28 %
Steel	14 - 15%
Fabric, fillers, Accelerators, Antioxidants, etc.	16 - 17 %

Truck tire	
Natural rubber	27 %
Synthetic rubber	14 %
Carbon black	28 %
Steel	14 - 15 %
Fabric, fillers, Accelerators, antioxidants, etc.	16 - 17 %

Tire Statistics & Facts

The average weight of a scrap passenger or light truck tire is 22.5 lbs.
The average weight of a scrap truck tire is 120 lbs.
The average weight of all scrap tires (light, medium & heavy truck) is 46 pounds.
84 percent of scrap tires are from passenger car tires.
15 percent of scrap tires are from light and heavy trucks.
One percent tires are from heavy equipment, aircraft and off-road tires.
15,000 Btu's are generated per pound of scrap tire rubber.
2.5 lbs of steel are contained in a steel belted radial passenger car tires.
7 gallons of oil (equivalency) are contained in a passenger car tire.
Specific gravity of tire rubber is 1.15.
Ten passenger or 3.5 truck tires are contained in a cubic yard.
Scrap tire piles are not treated as hazardous waste and are not biodegradable.

(Source: After Scrap Tire Facts and Figures 2009 Rubber Manufacturers Association 2011)

Two percent of scrap tires are exported to foreign countries to be reused as retreads, especially in countries with growing populations of automobile drivers such as Japan and Mexico. According to Mexico's National Association of Tire Distributors, as many as 20 percent of tires sold in Mexico are imported as used tires from the US and then retreaded for reuse. Some foreign countries also import tires to be shredded into crumb rubber or tire derived fuel. Unfortunately, not all exported tires are reused or recycled. The downside of exporting scrap tires is that the receiving countries may end up with a disproportionate amount of tires, in addition to their own internally-generated scrap tires.

For current information contact: RMA Environmental and Resource Recovery Department at 1400 K St, NW Washington DC 20005 Tel (202) 682-4800, www.rma.org

A complete Glossary of Scrap Tire Terminology was published by the Scrap Tire Management Council in April 1994. The glossary (Pub#GEN-015) is a 30 page collection of terms commonly used in the scrap tire industry:
http://www.rma.org/publications/scrap_tires/index.cfm?PublicationID=110013

Scrap tires are used in a number of productive and environmentally safe applications. From 1990 through 2009, the total number of scrap tires going to market increased from 24.5% to 84% of the 5,171 tons of tires that were generated.

Many uses have been found for recycled tires including whole tires, tire chips, shredded tires, and ground rubber. Retreading also saves millions of scrap tires from being disposed of as scrap each year.

Landfill Disposal

Tire piles/dumps can be found in big cities, small towns, and in rural areas. Cleaning up these sites is time consuming and expensive. In an effort to limit dumping and stockpiling, most states have passed scrap tire regulations requiring proper management. Many states have cleaned up large numbers of tire stockpiles. Minnesota, Wisconsin, and Maryland are three states which report having cleaned up all scrap tire stockpiles. For more information about illegal dumping, consult EPA's Illegal Dumping Prevention Guidebook (PDF) (33 pp, 1.1MB, About PDF)

Based on a survey of state agencies conducted by the Rubber Manufacturers Association in 2009, 90 percent of all scrap tires stockpiled in the US were concentrated in seven states. They are Colorado, Texas, Massachusetts, New Jersey, New York, Pennsylvania, and South Carolina in descending order.

Historically, scrap tires took up space in landfills or provided breeding grounds for mosquitoes and rodents when stockpiled or illegally dumped. Recycling and beneficial use of scrap tires continue to grow. Presently, only 12.8 percent of all scrap tires are land disposed in stockpiles, landfills, or monofills. Even with all of the reuse and recycling efforts, almost one eight of all the scrap tires end up being land disposed each year.

Landfilling of whole scrap tires can cause problems due to their uneven settlement and tendency to rise to the surface, which can harm landfill covers. To minimize these problems, many states require shredding or quartering of tires prior to disposal. Sometimes shredded scrap tires are incorporated into the landfill itself as part of construction of cells, daily cover, or leachate collection systems.

In recent years, the placement of shredded scrap tires in monofills, landfills, or portions of landfills that are dedicated to one type of material, has become more common. Monofills may be used where no other markets are available, and since municipal solid waste landfills do not accept tires. Monofills are preferable to above ground storage of tires in piles due to fire hazards and human health issues.

Scrap Tire stockpiles

In 1994, the estimated number of scrap tires in stockpiles in the US was 579 million. Since that time, millions of tires have been removed from stockpiles primarily due to aggressive cleanup through state scrap tire management programs. In 2009, 113.6 million tires were estimated to be in stockpiles. See Goals Committee Markets Trends Section for graph of the

U.S. Stockpiles Scrap Tires 1990 - 2010. In 2009, an additional 653.4 tons or 12.6 % of the generated scrap tires were disposed in landfills or monofills. (Source: Rubber Manufacturers Association, 2011).

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There has been some discrepancy between state decisions on whether to count active scrap tire monofills as stockpiles, thereby affecting grand total of tires stockpiled. For example, Colorado has two monofills, one containing some 75 million tires, and the other has some 50 million tires. In 2009, the State of Colorado stated these two were permitted as "active" operations and therefore not classified as stockpiles. Yet by all industry standards, the two monofills are disposal sites: scrap tires came in, some got processed and placed in above ground storage cells (at the larger of the two sites) or tires were simply placed into the ground without any processing. Since then, the larger of the two sites has been shut down, adding 75 million tires to the 113.6 million tires stockpiles increasing the grand total to 188 million tires. RMA visited the "smaller" monofill in December 2011 and maintains that the second smaller monofill, although still technically an active location is a disposal location which would further increase the grand total to 238 million when it is reclassified. (Source: Rubber Manufacturers Association, 2011).

State scrap tire program information:

- All 50 States have scrap tire regulation/legislation
- 35 States have scrap tire fees
- 38 States ban whole tires from landfills
- 17 states allow tire monofills
- 11 States ban all tires from landfills
- 8 states have no landfill restriction for tires

(Source: Scrap Tire Facts and Figures 2009 Rubber Manufacturers Association 2011)

To help state and local governments reduce the economic burdens and environmental risks associated with outdoor scrap tire piles, U.S. EPA Region 5 and Illinois EPA, with input from members of the EPA Scrap Tire Workgroup, have collaborated to create the Scrap Tire Cleanup Guidebook. The guidebook brings together the experience of dozens of professionals in one resource designed to provide state and local officials with the information needed to effectively clean up scrap tire piles. The guidebook discusses starting a cleanup program, working with contractors to clean up sites, and implementing prevention programs that will reduce scrap tire dumping. To order, send an email to nscep@bps-lmit.com and ask for publication #530-R-06-001.


Magic Johnson Park, Los Angeles, California. Poured in-place rubber made from recycled scrap tires

Best ways to reduce the number of scrap tires generated:

- Purchase longer-tread life tires
- Rotate tires every 6,000 miles
- Check for/inflate tires to recommended air pressure levels once a month or before a very long trip
- Balance tires when rotating them

(Source: RMA 2010 Market Survey)

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Uses/Markets

http://www.epa.gov/epawaste/conserve/materials/tires/uses.htm

Scrap Tire Uses/Markets

The four largest scrap tire uses are:

Civil Engineering Applications
Ground Rubber Applications
Rubberized Asphalt
Tire Derived Fuel

Other applications include:

Whole Tires, Cut, Stamped, Punched Products, and
Resale of used tires and Retreading

Both recycling and beneficial use of scrap tires have expanded greatly in the last decade through increased emphasis on recycling and beneficial use by state, local, and Federal governments, industry, and other associations. Today, there are even markets for the recycling of steel and fiber content removed through tires processing.

Each of the four largest uses will be described in detail in the sections to follow.

Unfortunately, even with all of the reuse and recycling efforts underway, not all scrap tires can be used beneficially. Many tires continue to be landfilled

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Civil Engineering Applications

http://www.epa.gov/epawaste/conserve/materials/tires/civil_eng.htm

Civil engineering markets encompass a wide range of uses for scrap tires as tire-derived aggregate (TDA). In civil engineering applications, TDA is utilized as a substitute for more traditional forms of aggregate due to its many favorable characteristics, such as light weight, high permeability, low thermal conductivity, vibration damping characteristics, compressibility, shear strength, and reduced lateral loading. TDA is typically utilized in civil engineering applications where the cost and engineering specifications make the use of TDA competitive with other more traditional forms of aggregate and fill. This often occurs in projects built over weak soils requiring light weight fills, projects in areas where traditional aggregate is scarce or not available, or other projects where the unique characteristics of TDA make it a viable and attractive option for the project manager and engineer(s).

TDA can come from either scrap tire stockpiles, abatement projects or from newly generated tires that have been processed (shredded) to meet the specifications established for the individual civil engineering project. TDA is generally processed to meet Type A or Type B specifications cited in ASTM specification D 6270-98 entailed Standards Practices for Use of Scrap Tires in Civil Engineering Applications. Typically a large Type A tire shred is 3-12 inches in size. Most states approve TDA for use in civil engineering applications, many without the need for issuance of solid waste management permits for the storage of TDA prior to final placement at the project site. (Source: Rubber Manufacturers Association, 2011) EXIT Disclaimer

The Scrap Tire Workgroup's Civil Engineering Committee, Illinois Environmental Protection Agency and the USEPA's Office of Resource Conservation and Recovery (ORCR) produced an educational DVD titled Tire-Derived Aggregate (TDA) in Civil Engineering Applications. The DVD is available is standard form and on YouTube at: http://www.youtube.com/watch?v=aJmK3WDuEV4

- Tire-Derived Aggregate in Civil Engineering Applications (MP4) (5.45 min, 81MB) | en Espanola and English
- Video plays on the QuickTime Player and requires you to have the QuickTime Player Plug-in EXIT Disclaimer
- NOTE: Download time for the video may vary depending on the speed of your Web connection and other factors.

- To request a DVD of the full-length video, contact Mark Schuknecht, 703-308-7294

Beneficial Use of Tire-Derived Aggregate in Civil Engineering Applications

Defined as the use of shredded scrap tires, referred to as tire-derived aggregate (TDA) in various civil engineering projects in lieu of conventional aggregate materials

Shreaded tires, Note ruler for scale

Why Use Tire Shreds?

TDA has physical and chemical properties that may establish it as viable, desirable, and affordable alternative to traditional forms of aggregate factors when designing, planning, and implementing a civil engineering project.

TDA's physical and chemical properties:

- Lightweight (1/3 weight of soil)
- Low thermal conductivity (8 X better than soil)
- High permeability (10 X better than soil)
- Compressibility
- Excellent vibration damping
- Reduced lateral loading (high shear strength)

Source: Shredding Systems Inc.

TDA may be beneficial and cost-effective where there is weak underlying soil structure due to its:
- Light weight
- Compressibility
- Reduced lateral loading (high shear strength)

TDF Pile (source: http://americanrecycler.com/)

Types of Civil Engineering Applications

Lightweight fill (road construction) 	**Lightweight fill (bridge embankments)** 
Structure foundation backfill 	**Lightweight fill (road embankments)** 
Landfill construction/remediation 	**Septic field drainage medium** 
Other Uses	
Vibration damping (rail) 	**Sound barriers** 

Lightweight Fill in Road Construction

TDA can be an attractive alternative to traditional forms of aggregate to construct roads and embankments over weak, compressible foundation soils. Tire shreds are viable in this application due to their light weight, high permeability, compressibility, and reduced lateral loading (high shear strength) characteristics. For some civil engineering projects, utilizing TDA as a lightweight fill material in place of other forms of aggregate is significantly cheaper than the more traditional lightweight alternatives.

Specific examples of projects using scrap tires as subgrade fill and/or embankments include:

- Two highway embankments on weak clay in Portland, Maine
- An interstate ramp across a closed landfill in Colorado
- Mine access roads across bogs in Minnesota
- Stabilization of a highway embankment in Topsham, Maine
- Reconstruction of a highway shoulder in a slide prone area in Oregon

Other applications of TDA in road construction projects include retaining dirt forest roads, protecting coastal roads from erosion, enhancing the stability of steep slopes along highways, and reinforcing road shoulder areas.

For additional information, see:

- US DOT Federal Highway Research Center, User Guidelines for Tires Shreds as Embankment or Fill
- Texas DOT Specifications for the Use of Recycled Materials EXIT Disclaimer

Backfill for Walls and Bridge Abutments

TDA can be useful as backfill for walls and bridge abutments. The light weight shear strength and compressibility of tire shreds reduces lateral loading (horizontal pressure) and allows for construction of thinner, less expensive walls. Tire shreds can also reduce problems with water and frost build up behind walls because of TDA's high permeability and low thermal conductivity. The establishment of ASTM standards for this use has been beneficial in the enhanced acceptance of this application in the road construction industry.

Subgrade Insulation for Roads

In northern climates, roads are subject to frost heaving of road surfaces caused by water freezing in the frost zone below roads with certain underlying soils. This phenomenon can be destructive to roads and dangerous for drivers. When placed in the appropriate zone in a road's sub-base, TDA's low thermal conductivity can decrease the rate of frost penetration and its high permeability can improve water drainage under a roadway. The combination can reduce frost heaving and its associated damage to road surfaces.

For more information on civil engineering applications, consult:

- ASTM specifications for use of tire shreds in civil engineering applications, specifically ASTM D6270-98-available on the ASTM Web site EXIT Disclaimer [Note: users must pay to download/view a copy of the ASTM specifications]
- state DOT engineering reports
- leachate data
- training courses on highway and landfill applications.

Commented [MRS4]: Vague: The average reader would want to find these items
-what leachate data
-which training courses
-when and where to look
Perhaps links to training events listed on websites such as RMA Ind Res Council etc

Landfill Construction/Remediation

Landfill construction and operation is a growing market application for tire shreds. Scrap tire shreds can replace other construction materials that would have to be purchased. Scrap tires may be used as a highly permeability backfill in gas venting systems, in leachate collection systems, and in shock-absorbing operational liners. They may also be used in landfill capping and closures, and occasionally as a component in daily cover.

Septic System Drain Fields

Many states (e.g. Alabama, Arkansas, Florida, Georgia, South Carolina, Virginia) allow TDA to be utilized as a drainage medium in septic system leach fields. This civil engineering application is becoming more established in many areas of the U.S. as commercial septic system installers and state and local health departments become more familiar with the concept, specifications and performance of this application. TDA can be of particular value in areas of the U.S. where traditional forms of aggregate are unavailable or scarce and therefore more expensive than TDA. TDA can also increase system performance because it holds more water than many other forms of aggregate due to the increased void space available within the tire shreds.

Challenges to utilizing TDA in septic systems include obtaining quality TDA that meets ASTM state and local permit specifications. In some areas, traditional forms of aggregate are readily available and significantly less expensive than TDA, thereby making TDA a less attractive alternative.

Well Established and Non-Experimental

The use of TDA in civil engineering applications is an established practice and is not considered an experimental application. ASTM standards have been established to ensure the use of properly sized TDA to prevent thermal issues and many such projects have been conducted successfully across the U.S. Consult the TDA civil engineering compendium for more information on specific TDA projects in civil engineering applications with product specifications and contact information.

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Ground Rubber Applications

http://www.epa.gov/epawaste/conserve/materials/tires/ground.htm

Background

The market for ground rubber has been growing over the past several years. In 2009, ground rubber markets accounted for over 1,300,000 tons of tires recycled representing 28% of the market, up from 17% in 2007. While the market share for ground rubber has been growing, it needs even more markets to sustain growth.

In 2009, 1,702 million pounds of ground rubber were used for:

Automotive (new tires etc)	115 million pounds
Molded/Extruded/bound products	440 million pounds
Sports Surfacing	520 million pounds
Playground/mulch	120 million pounds
Mulch/landscaping	162 million pounds
Export	115 million pounds
Total	1,702 million pounds

(Source: Scrap Tire Facts and Figures 2009 Rubber Manufacturers Association 2011)

Why Use Ground Rubber?

- Ground rubber, also known as "crumb rubber", is particulate rubber derived from grinding scrap tires.
- Ground rubber has properties that make it a good raw material for several different products.
- The market value of ground rubber is higher than other recycled tire products.

Ground Rubber Definition

- Ground Rubber is defined by ASTM[1]
- Various terminology/sizes of ground rubber
- Tire Buffings: by-product of the retreading industry
- Coarse Rubber: 1 inch to 4 mesh2

Commented [MRS5]: Editorial Note Footnote 1

Commented [MRS6]: Editorial Note Footnote 2 continues on next page

[1] See the definitions section of ASTM D 6270 *Standard Practice for Use of Scrap Tires in Civil Engineering Applications*. Also see D 5603 *Standard Classification for Rubber Compounding Materials – Recycled Vulcanizate Particulate Rubber* and D 5644 *Standard Test Methods for Rubber Compounding Materials—Determination of Particle Size Distribution of Recycled Vulcanizate Particulate Rubber*

- Ground Rubber: 10 to 80 mesh
- Fine Grind Rubber: 80 to 400 mesh

Ground Rubber Economics 101

- TDA (generally 1”- 6” in size) typically sells for \$16 to \$28 per ton[3]
- TDF (1”-2”) typically sells for \$24 to \$36 per ton
- Whole Tire TDF typically has a tipping fee of between \$12 to \$68 per ton
- Ground rubber sells for 9¢ to 65¢ per lb. Grinding tires will yield between 60-70% of recoverable ground rubber
- The rest is steel (~12%), fiber and residuals
- 2,000 lbs/ton x ~65% x (9¢ to 65¢)/lb. = \$117 to \$845 per ton of tires
- Add back the value of the steel but subtract for fiber and residual disposal.

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Commented [MRS8]: This seems to be low? \$218 – \$1275/ton

Source: Scrap Tire & Rubber Users Directory 2012, published by Scrap Tire News.

[2] Mesh sizing is defined by the number of holes in a linear inch on a sizing screen – the higher the number, the smaller the hole-size (Therefore, 10 mesh means 10 holes to the linear inch or 100 holes to the square inch) Source: Rubber Manufacturers Association

[3] Size characterizations and prices reported for 2011 as reported in the Scrap Tire and Rubber Users Directory 2012 published by Recycling Research Institute/Scrap Tire News

Ground Rubber Processing

It takes a lot more effort, machinery and skill to make good quality ground rubber than it does to make either TDF or TDA. There are two major processing technologies:

- Ambient grinding makes particles with rough surfaces (higher surface area) because of the tearing/compression action in the grinding process
- Cryogenic grinding produces smoother particles because the frozen rubber is then shattered with a hammermill

Each technology has advantages and disadvantages. The chosen technology ultimately depends on the final market application depending on the final market

Athletic and Recreational Applications

Examples and benefits of using scrap tires in this market segment include:

- Ground cover under playground equipment – possesses high impact attenuation/ability to absorb the energy from falling children and objects.
- Running track material – increases a track's resiliency and decreases stress on runners' legs.
- Sports and playing fields – as a soil additive, increases the resiliency of the field thereby decreasing injuries, improves drainage, and enables better grass root structure.

Rubber mulch at a public playground in Pennsylvania

Ground rubber is often used as infill between blades of artificial grass in a carpet-like application. In this Youtube link, the ground rubber is the final installation step. It start at approximately four minutes into the video.
http://www.youtube.com/watch?v=n_9X_wqYGbc&feature=related EXIT Disclaimer

The Scrap Tire & Rubber Users Directory 2012, published by Recycling Research Institute /Scraptire News contains listings of machinery manufacturers and other useful data.

Common Ground Rubber Markets

- Synthetic turf
- Ground rubber is used as infill between blades of plastic grass in a carpet-like application
- Surface more durable than grass and less subject to weather restrictions

- The rubber helps keep the blades upright and cushions falls
- Initially popularized by professional football, is now commonly used for many different college and high school sports (soccer, lacrosse, etc.)
- Playgrounds
- Ground rubber is applied to a uniform depth around playground equipment to protect children from falls
- Three common variations are:
  - Loose fill (mulch-like) http://www.youtube.com/watch?v=AKlfiNV-iwU EXIT Disclaimer
  - Pour-in-place: a liquid urethane binder is blended on-site and the material is troweled-on to create a smooth surface http://www.youtube.com/watch?v=i_QYDmQaMsw&feature=related EXIT Disclaimer
  - Tiles made in a factory http://www.youtube.com/watch?feature=endscreen&v=OguY7R3Ut4A&NR=1 EXIT Disclaimer

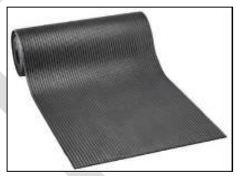

- Mulch
  - Rubber mulch is used as longer-lasting alternative to bark and other natural mulches to keep out weeds and/or help retain soil moisture
  - It is often used around plants, backyard pools, foundations and other objects http://www.youtube.com/watch?v=AKlfiNV-iwU EXIT Disclaimer


(Pictures show artistic use of colored mulch manufactured in Arkansas)

- Molded Products
  - Plastic, virgin rubber, urethane or other binders are combined with ground rubber to mold parts

- Large compression molded objects such as tiles and signpost holders are the least technical of these applications
- Injection molding can yield much more technical parts such as roof tiles
- Ground rubber can be made into sheet goods to make things like automobile splash guards





(Examples of molded products)

There are more than 130 new products that contain recyclable tire rubber.

A list of products made with recycled tire rubber can be found at:

http://www.rma.org/publications/scrap_tires/index.cfm?PublicationID=11297 EXIT Disclaimer

Other uses for ground rubber include:

- New tire manufacturing (up to 10% or higher as per Scrap Tire News EXIT Disclaimer).
- Equestrian: ground rubber is increasingly popular as a component for high-quality horse competition and horse racing surfaces
- Cow Mattresses: loose ground rubber is used to stuff these pillow-like products
- Road Noise Barrier Walls: one company is using ground rubber by incorporating it into concrete as a noise absorbing material
- Adhesives, Paints, Treated Rubber, etc.(link to RMA website)
- Carpet underlayment, flooring material, patio decks, roof walkway pads, rubber tiles and bricks and movable speed bumps
- Brake pads and brake shoes
- As a component of extruded plastic products like railroad cross ties

For information on risk associated with use of ground rubber in artificial sports fields see: the Environmental Issues Section. (*link*)

Commented [MRS9]: Editorial Note: link

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Rubberized Asphalt Applications

http://www.epa.gov/epawaste/conserve/materials/tires/ground.htm

Figure1. Rubberized Asphalt Project in Charleston, SC

Rubberized asphalt is the largest single market for ground rubber, consuming an estimated 220 million pounds or approximately 12 million tires a year. Rubberized asphalt is being used in greater amounts by state Departments of Transportation. California, Arizona, and Florida have been leaders in rubberized asphalt utilization (over 80% of rubberized asphalt used). Texas and some other states (e.g., Nebraska, Georgia, South Carolina, Louisiana, etc.) are currently using greater amounts of rubberized asphalt (Figure 1). Other states that have studied and/or used rubberized asphalt include New York and New Mexico among many others.

Ground tire rubber can be blended with asphalt to beneficially modify the properties of the asphalt in highway construction. Ground rubber from scrap tires can be used as part of the asphalt rubber binder (referred to as asphalt rubber if over 15% crumb rubber by weight of the binder is utilized), seal coat, cap seal spray or joint and crack sealant, or many other applications.

There are many benefits to using rubberized asphalt including, but not limited to, the following:

- Increases pavement life
- Reduces maintenance costs
- Decreases noise levels (Open Graded Friction Course layers)
- Reduces reflective cracking in asphalt overlays
- Improves resistance to cracking in new pavements
- Improves resistance to rutting in new pavements
- Utilization of 500-2,000 scrap tires per lane mile depending on the application
- Improves skid resistance and shorter breaking distances

Figure 2, in Arizona, shows the effectiveness of the Open Graded Friction Course (OGFC) application utilizing rubberized asphalt mixtures. A major safety issue during rain is the splashing caused by traffic. The left side of this pavement is an OGFC mix and the right hand side is normal concrete pavement (same pavement section). It is obvious to see the benefits of such mixtures during inclement weather.

Figure 2. Open Graded Friction Course (OGFC) in Arizona during rain. The left side is an OGFC mix compared to the right hand side which is a concrete pavement not covered with the OGFC. Research has shown that OGFC will produce a safer pavement during an inclement weather condition (e.g., rain).

Definitions and terms

- HMA: Hot Mix Asphalt: A combination of virgin or modified binder (asphalt cement), aggregates (rocks), and any admixtures, if needed; mixed thoroughly.
- Rubberized Asphalt: Any mixture of virgin binder, aggregate (rocks), and crumb rubber.
- Asphalt Rubber: According to the ASTM definition (ASTM D 8, Vol. 4.03, "Road and Paving Materials" of the Annual Book of ASTM Standards 2001) asphalt rubber is "a blend of asphalt cement, reclaimed tire rubber, and certain additives in which the rubber component is at least 15 percent by weight of the total blend and has reacted in the hot asphalt cement sufficiently to cause swelling of the rubber particles".
- Asphalt Cement: It is the by-product of the refinery process and used as the glue (referred to as binder also) to keep the aggregates (rocks) together. It is in a solid or semi solid format except when is heated (over 250 F) then becoming liquid.
- Asphalt Concrete: A compacted HMA used as a roadway. The compaction takes place with compactors.
- CRM: Crumb Rubber Modifier: Scrap tires shredded and processed (e.g., removal of fibers and steel) in various sizes to be used in a typical rubberized mixtures or an asphalt rubber.
- PCC: Portland Cement Concrete: A combination of aggregates (rocks), Portland cement (used as the binder), water, and admixtures, if needed.

- SAM: Stress Absorbing Membrane: It is used, usually, over a badly cracked existing pavement in order to retard reflective cracking. It is a mix of CRM and virgin binder applied to the surface of existing pavement.
- SAMI: Stress Absorbing Membrane Interlay: It is a SAM with an overlay. The overlay could be either a typical HMA mix or a modified mixture.
- OGFC: Open Graded Friction Course: It is a mixture of rubberized asphalt having a very high air voids (over 16% compared to a typical dense graded mixture that has 4% air by volume) that is placed usually over an existing pavement for reducing the traffic noise or removing the water during rain.
- ARFC: Asphalt Rubber Friction Course: Same as OGFC, except that the modified binder has at least 15%, by weight of the binder, CRM in the matrix.
- Wet Process: The CRM is added to the binder and is, usually, mixed at the job site before adding the modified binder to the aggregate.
- Dry Process: The CRM is added to the aggregate before adding the hot binder. This process is not being utilized in USA as much as other methods.
- Terminal blend: The CRM is added to the binder, usually, at an offsite location and the matrix transported to the contractor's plant. In some cases, some other materials or chemicals are added to the matrix.

Types of Rubberized Asphalt

Crumb rubber can be incorporated into asphalt paving mixes using different methods including, but not limited to, the following: the wet process, dry process, and terminal blend. In the wet process, crumb rubber acts as an asphalt cement (binder) modifier. However, in the dry process, granulated or ground rubber and/or crumb rubber is used as a portion of the aggregate. In both cases, crumb rubber is sometimes referred to as crumb rubber modifier (CRM) because its use modifies the properties of the final product (hot mix asphalt (HMA) mixture). The terminal blend is a form of the wet process where CRM is blended with hot asphalt binder at the refinery or at an asphalt binder storage and distribution terminal. This product is then transported to the asphalt mixing plant. There are many techniques used to produce terminally blended materials using 3% to over 10% CRM (by weight of the binder) and, in some cases, adding some polymers to the matrix.

Wet Process

In the United States, most of the experience with the use of CRM in asphalt paving has been with the wet process. The wet process can be used for many applications including, but not limited to, the following: hot mix asphalt paving mixtures, chip seals or surface treatments, and as rubberized joint and crack sealants.

When at least 15% CRM, by weight, is blended with the asphalt binder (asphalt cement) in the wet process, the modified binder is referred to as asphalt-rubber. According to the ASTM definition (ASTM D 8, Vol. 4.03, "Road and Paving Materials" of the Annual Book of ASTM Standards 2001) asphalt rubber is "a blend of asphalt cement, reclaimed tire rubber, and certain additives in which the rubber component is at least 15 percent by weight of the total blend and has reacted in the hot asphalt cement sufficiently to cause swelling of the rubber particles". By definition, "asphalt rubber" is prepared using the "wet process". This matrix is reacted before the binder is added to the aggregate. When binder (asphalt cement) and CRM are blended together, the CRM reacts by swelling and softens. This reaction process, in general, is influenced by the temperature and the length of time at which the blending occurs, the type of mechanical mixing, the size and texture of the CRM, and the aromatic component of the asphalt cement. This reaction is not a chemical process since it involves the absorption of aromatic oils from the binder (asphalt cement) into the polymer chains that comprise the major structural components of natural and synthetic rubber in CRM. This rate of reaction between CRM and the binder (asphalt cement) is influenced by many factors. The viscosity of the composite binder, in many cases, is the primary parameter that is used to monitor the reaction.

SAM and SAMI:

After years of exposure to the elements, asphalt may lose some elasticity or resiliency through oxidation, in addition to being subjected to repeated stresses from expansion and contraction due to temperature changes. Due to these distresses cracks begin to appear. In general, rubberized asphalt mixtures resist the formation of these cracks much better than conventional asphalt mixtures. These rubber-modified asphalt mixtures exhibit more elasticity than unmodified asphalt binders, in addition to be able to resists aging. This anti-aging effect is the result of anti-oxidants contained in the scrap tires.

Reflective cracking is one of the distresses in flexible pavements (asphalt pavements). This occurs in asphalt overlays where the crack patterns in the pavement structure underneath reflect to the surface. Frequently, they are found in asphalt overlays over Portland Cement concrete (PCC or rigid pavements) and cement-treated bases (Figure 3). These cracks are caused by vertical or horizontal movements in the pavement beneath the overlay resulting from traffic loads, temperature, and earth movements. Applications such as Stress Absorbing Membranes (SAM) or Stress Absorbing Membrane Interlayers (SAMI) greatly reduce the occurrence of reflective cracking because of their elastic properties. The elastic properties of the rubberized asphalt materials used in a typical SAM or SAMI application will allow the materials to effectively stretch and move with the underlying pavements rather than cracking from the stresses. In general, SAM is a surface treatment that is used primarily to restore surface frictional characteristics, seal cracks and provide a waterproof membrane to minimize the intrusion of surface water into the pavement structure. A SAMI is an asphalt rubber SAM that is overlaid with an asphalt paving mix that may or may not include CRM. The SAMI layers, in general, delay the propagation of the cracks (reflective cracking) through the new overlay. The binder used to construct a typical SAM or SAMI usually contains at least 15% crumb rubber by total weight of binder.

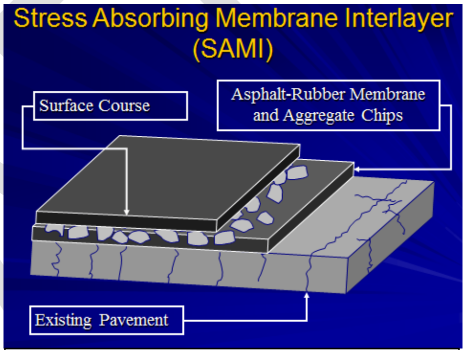

Figure 3. A typical schematic of a SAMI

Figure 4 Before

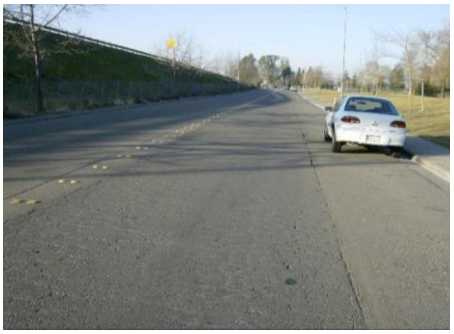

Figure 5 After SAMI

Figure 4 & 5: Surface of Roberts Lake Road (City of Rohnert, California): a) Before resurfacing and b) After applying rubberized asphalt mixture, 2008

Safety and Noise Reduction

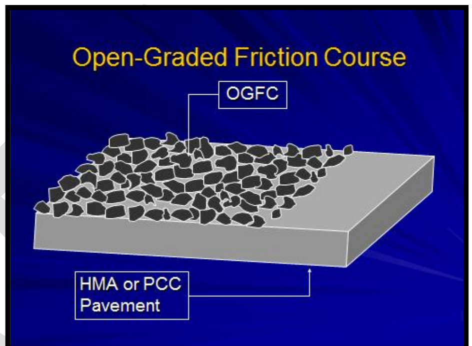

Figure 6. A typical schematic of an OGFC mix

In several parts of the US and elsewhere throughout the world, many issues have contributed to highway noise problems including: urban population growth, more vehicles on the road, increased traffic volume, larger vehicles, and lack of new roads. There are many ways to reduce traffic noise in major cities including: quieter exhaust systems and engines, more efficient aerodynamic vehicle designs, quieter materials for automobiles, tire tread designs, and quieter paving materials and pavements. There are many noise mitigation strategies including; but not limited to: a) buffer zones, b) noise barriers, c) vegetation, d) sound insulation, and e) traffic management. Many of these techniques could be fairly effective; however, the costs of many of these applications are very high. One method that has shown promise, in many parts of the world, is the use of rubberized asphalt (Open Graded Friction Course: OGFC) to mitigate noise (See Figure 6). This type of mix, in general, has over 18% air voids; it increases the friction, reduces water spray, and reduces pavement noise. Several reports indicate that, in many parts of the country (e.g., California, Arizona, Texas, etc.), these pavement types have reduced the noise levels from 5 to 10 dBA. Figures 7 & 8 shows the noise levels (dBA) of many pavement types in California and Arizona. The results show that most of the OGFC mixtures reduce the noise levels by several decibels. In this case, one of the OGFC pavements reduced the noise levels by over 12 decibels compared to a concrete pavement. This type of reduction level cuts the noise level by over half.

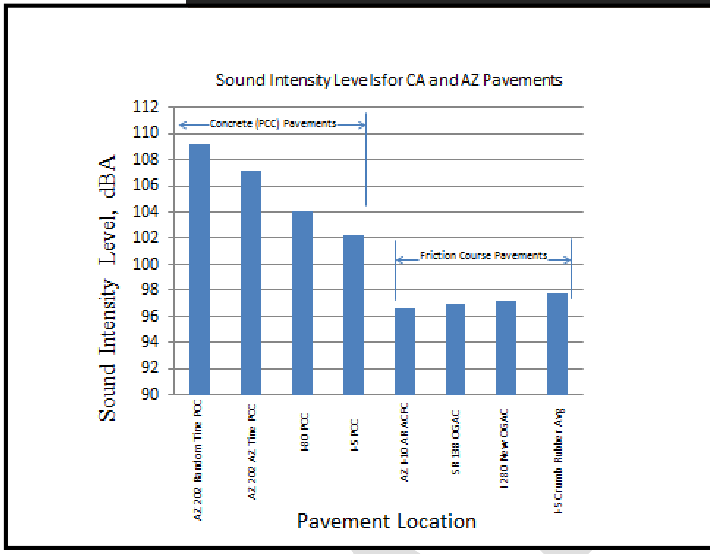

Figure 7. Comparison of various concrete and open graded friction courses in California and Arizona

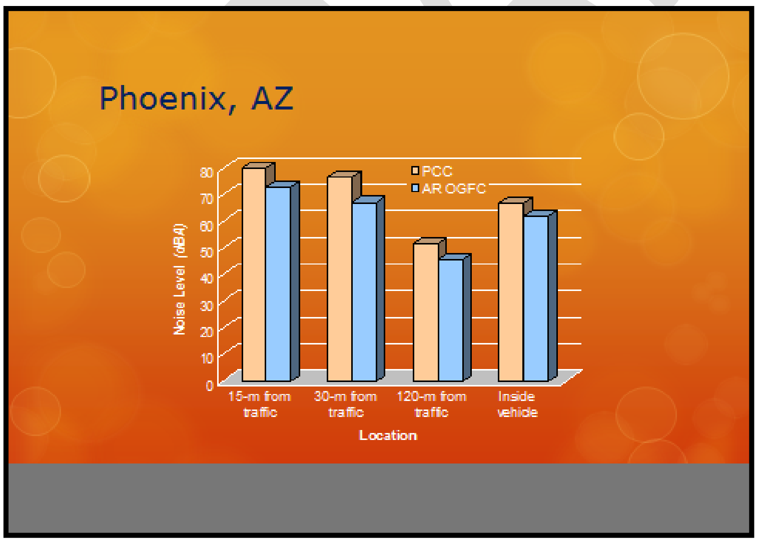

Figure 8. Phoenix, AZ: Noise level generated at various distances from traffic

(PCC: Portland Cement Concrete Pavement; AR OGFC: Asphalt Rubber Open Graded Friction Course)

For additional information, see:

- Rubberized Asphalt Concrete Technology Center (RACTC) EXIT Disclaimer
- Rubber Pavements Association EXIT Disclaimer
- U.S. DOT Federal Highway Research Center EXIT Disclaimer
  - Asphalt Concrete (Wet Process)
  - Asphalt Concrete (Dry Process)
  - Embankment or Fill
- Texas DOT Recycling Program EXIT Disclaimer and Texas DOT Specifications for the Use of Recycled Materials EXIT Disclaimer
- Florida - Study of the Suitability of Ground Rubber Tire as a Parking Lot Surface (45 pp, 7MB, about PDF) EXIT Disclaimer
- California - Green Roads: Paving the Way With Recycled Tires

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For more information and technical papers, please see the Proceedings of Asphalt Rubber 2000, 2003, 2006, and 2009 Conferences conducted around the world.

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Tire-Derived Fuel

http://www.epa.gov/epawaste/conserve/usess/tires/tdf.htm

Commented [MRS10]: Revisions entered form George. Pending reviews by Terry Gray

Background | Cement Industry | Pulp and Paper Industry | Electric Utilities | Industrial/Institutional Boilers | Dedicated Tire-To-Energy Facilities

Background

Tires can be used as fuel - known as tire-derived fuel (TDF) - either in shredded form or whole, depending on the type of combustion device. Scrap tires used as Tire Derived Fuel is the largest current market. In 2009, 164 million scrap tires were used as fuel (about 54% of all generated) – The same percentage as 2007 up from 25.9 million (10.7% of all generated) in 1991.

Scrap tires are used as fuel because of their high heating value. Scrap tires are typically used as a supplement to traditional fuels such as coal or wood. Using scrap tires is not recycling, but is considered a sustainable use - it is better to recover the energy from a tire rather than landfill it. Because of the change in the definition of solid waste, certain whole tires from scrap tire pile clean-ups may be considered solid waste and require a solid waste combustor air permit. Other whole tires, from retailers under a state manifest, do not require the more stringent permit. Generally, tires need to be reduced in size to fit in most non-cement kiln combustion units. Additionally, TDF may require additional physical processing, such as de-wiring. A dramatic increase in fuel prices over the last two decades, has caused industry to seek out Tire Derived Fuel (TDF) as a way to lower operating costs while meeting air emission standards.

> Tire-Derived Fuel Frequent Questions
>
> Why use tires as fuel when there are other ways to recycle scrap tires?
>
> What are the trends of scrap tires used as fuel versus other market applications?
>
> What are the benefits of using tires as fuel?
>
> How is TDF regulated prior to processing?
>
> Have any standards been developed for the physical characteristics of TDF?
>
> **Background:** Tire chips were used as a blended fuel at the Utilicorp United Power Plant in Sibley, MO. Visit Missouri's Division of Environmental Quality EXIT Disclaimer for more information.

In addition to size reduction, there are several advantages to using tires as fuel:

- Tires produce the same amount of energy as oil and 25% more energy than coal.
-

- The ash residues from TDF may contain lower heavy metal content than some coals.
- Results in lower Sox and NOx emissions when compared to many US coals, particularly the high-sulfur coals.

EPA supports the highest and best practical use of scrap tires in accordance with the waste management hierarchy, in order of preference: reduce, reuse, recycle, waste-to-energy, and disposal in an appropriate facility. Disposal of scrap tires in tire piles is not an acceptable management practice because of the risks posed by tire fires, and because tire piles can provide habitats for disease vectors, such as mosquitoes. TDF is one of several viable alternatives to prevent newly generated scrap tires from inappropriate disposal in tire piles, and for reducing or eliminating existing tire stockpiles.

Based on over 20 years of experience with more than 80 individual facilities, EPA recognizes that the use of tire-derived fuels is a viable alternative to the use of fossil fuels. EPA testing shows that TDF has a higher BTU value than coal. The Agency supports the responsible use of tires in Portland Cement kilns and other industrial facilities, so long as the candidate facilities: (1) have a tire storage and handling plan; (2) have secured a permit for all applicable state and federal environmental programs; and (3) are in compliance with all the requirements of that permit.

Scrap Tire Fuel Use by Industry

Of the 164 million scrap tires used as fuel per year:

- Cement industry - 29%
- Pulp and paper mills - 234%
- Electric utilities - 16%
- Industrial/institutional boilers - 11%
- Dedicated tire-to-energy facilities - 10%

- Rubber Manufacturers

This information is also contained in a printable fact sheet on TDF (PDF) (1 pg, 12K, About PDF)

Scientific Basis

Basis for use with coal:
TDF vs. Coal Comparative Characteristics

Characteristic	**W. Ky Coal**	**TDF (OMU)**
Proximate Analysis (% as received)		
Ash	10.75	7.12
Moisture	12.02	3.44
BTU/Lb	11,134	15,201
% Sulfur	3.28	2.14
LBS/MMBTU SO_2	5.89	2.82
Ultimate Analysis (Dry Basis)		
Carbon	69.08	81.02
Hydrogen	4.86	7.07
Nitrogen	1.40	0.48
% Sulfur	3.73	2.22

(Source: TAG Resource Recovery)

Elemental Ash Analysis (% Oxide Form)

Element	Eastern Bituminous	TDF (90% wire-free)
Aluminum	2.29	<0.01
Barium	-	ND
Cadmium	-	0.0006
Calcium	0.36	0.378
Chromium	-	0.0097
Iron	2.09	0.321
Lead	-	0.0065
Magnesium	0.08	<0.01
Manganese	-	<0.01
Phosphorous	0.07	<0.01
Potassium	0.22	<0.01
Titanium	0.09	<0.01
Silicon	5.30	0.516
Sodium	0.05	<0.01
Strontium	-	<0.01
Sulfur	0.47	1.23
Zinc	**0.01**	**1.52**
Chloride	-	0.149
Fluoride	-	0.001

Cement Industry

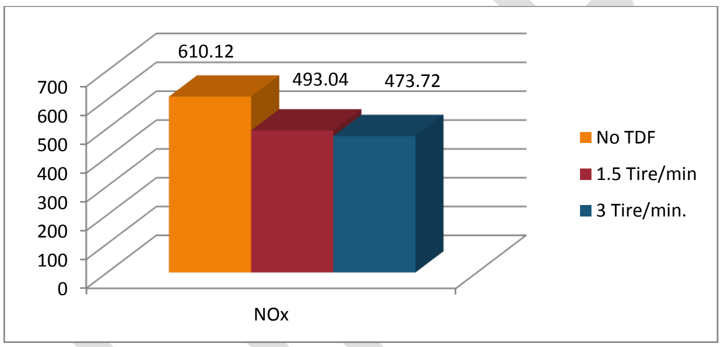
About 54 million passenger tire equivalents per year are consumed as fuel in US cement kilns. The cement industry burns scrap tires as fuel in kilns used to make clinker-a primary component of Portland Cement. A cement kiln is basically a large furnace in which limestone, clay, and shale are heated at extreme temperatures and a chemical reaction transforms them into clinker. Clinker is ground together with gypsum to form Portland cement.

The use of whole tires as kiln fuel is possible for some type of cement kilns. For these cement kilns, truck loads of whole tires, usually in enclosed vans, are delivered to the end of a conveyor. Tires are manually unloaded from the truck onto the conveyor. The conveyor feeds the tires to a mechanism that inserts one tire at a time into the kiln at specified time intervals. The advantage of utilizing whole tires is that there are no costs to create tire chips. The removal of the steel is unnecessary since cement kilns incorporate the iron into the clinker. Tire chips may also be utilized because there is very little manual labor involved in handling chips versus whole tires; however, producing chips from whole tires increase costs.

The use of tires in cement kilns commonly reduces the nitrous oxides (NOx), since the burning of the tire is cooler than the normal kiln temperature of 2,00-2,500 degrees Farenheight.

Here are test results from one actual emissions test for a cement kiln in the Southeast:

Units: Lbs/hr



Pulp and Paper Industry

About 64 million passenger tire equivalents per year are consumed as fuel in boilers at US pulp and paper mills. Pulp and paper mills have large boilers which are used to supply energy for making paper. This energy is normally supplied by wood waste; however, wood varies substantially in heat values and moisture content, so the mills often supplement the wood fuel with other fuels, such as coal or oil, to make the operation more stable. TDF is also used in many plants as a supplement to the wood because of its high heat value and low moisture content.

The main problem in using TDF in the paper industry is the need to use de-wired tires. The wires often clog the feed systems. Also, the mills sometimes sell the resulting ash to farmers who require the ash to be free of iron. De-wired TDF can cost up to 50% more than regular TDF.

Paper Mill TDF emissions show an increase in some parameters and a decrease in others, but the permit limits are maintained.

In Figure 1, the use of TDF does slightly increase total selected metals (TSM) and Particulate Matter (PM) because of the zinc used in the vulcanization process in tire manufacturing. To meet permit limits, owners counter the increase in metals with a good pollution control system meeting today's standards, such as an electrostatic precipitator (ESP). In Figure 2, nitrous oxides (NOx) and carbon monoxide (CO) slightly decreased due to better controlled burning in the hog fuel boiler. In Figure 3, the emissions test for dioxin/furans (D/F) shows a random distribution, which is typical. D/F formation is more dependent on the pollution control flow design, and the speed of cooling from 800 degrees F to 400^{O}F. A slower cooling train with more crevices and structures encourages D/F formation.

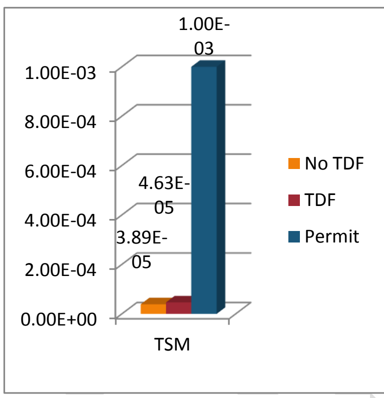


Figure 1: Total Selected Metals in lbs/ MMBtu

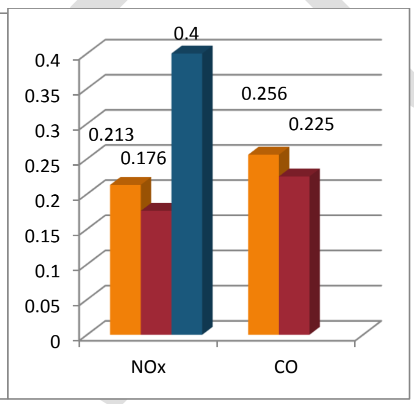


Figure 2: NOx & CO in lbs/ MMBtu

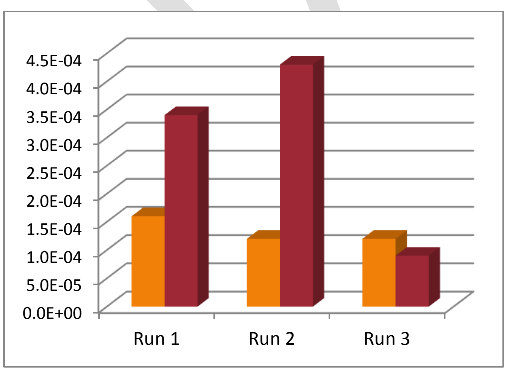


Figure 3: Dioxinx'Furans In ng/ft^3

Electric Utilities

About 29 million passenger tire equivalents per year are consumed as fuel in boilers at electric utilities. In the electric utility industry, boilers typically burn coal to generate electricity. TDF is often used as a supplement fuel in electric utility boilers because of its higher heating value, lower NOx emissions, and competitive cost as compared to coal. TDF also lowers SOx in high-sulfur coals. However, only certain types of boilers are conducive to burning TDF.

Cyclone boilers are the most used of all the utility boilers for burning TDF. They are good because they require no changes to be made to the boiler itself, which reduces the capital investment. Therefore, the only additional equipment needed is a conveyer to transport the tire pieces into the boiler. Cyclone boilers cannot accept whole tires which increases the cost of obtaining the fuel (the optimum size of the tire pieces is 1 inch x 1 inch and it must be de-wired). Stoker fired units are also economical. In the stoker boilers, the residence time of the fuel is longer so larger tire pieces can be used. The optimum size of these pieces is 2 inches square. This reduces the cost of obtaining the fuel for Cyclone boilers and makes it more economical.

The following figures show one typical electric utility boiler "A" emissions when using TDF.

Figure 4 is for PM and volatile organic compounds (VOCs). PM emissions increase slightly, but not above permit limits. PM normally increases with the use of TDF, due to the use of 1-1.5% zinc oxide by weight in the vulcanization process. Zinc emissions are released through combustion, and the particulate control must be designed to handle the increase. Since PM is an issue with coal, most coal-fired electrical generating stations already have state-of-the-art baghouses or electrostatic precipitators. No modification is usually necessary to add TDF as a small percentage of the total coal feed.

VOCs increase slightly, but again not above permit limits. TDF has higher VOC content than coal, but the combustion process burns volatiles, lowering the final emission.

Figure 5 shows Sulfur Dioxide (SO_2), Nitrous Oxide (NO_X) & Carbon Monoxide (CO) emissions at the same plant.

SO_2 increases slightly, but not above permit limits. Whether SO_2 goes up or down depends on the comparison of Sulfur in TDF vs. the coal used. For example, the elemental ash analyses on the last page show Eastern Bituminous to yield 0.47% in ash, while TDF leaves 1.23%. Therefour, one would surmise that SO_2 emissions would slightly increase with the use of TDF with Eastern Bituminous coal.

Figure 6 is for Beryllium (Be) and Mercury (Hg)

Be was found to be at 2.57 ppm on a whole coal basis in West Virginia coal, according to http://www.wvgs.wvnet.edu/www/datastat/te/BeHome.htm

Be is slightly measured at a coal-fired power plant using 2% TDF at 0.00966 lb/hr in Table A-6b of http://www.epa.gov/ttncatc1/dir1/tire_eng.pdf
In this case, the Be in the TDF is less than in the coal since there is a slight decrease when using TDF.

Hg in coal used at selected Part III ICR plants has a median of 0.101 ppm according to http://www.epa.gov/ttn/atw/combust/utiltox/uarg_hg_coal_summary.pdf
The Portland Cement Association (PCA) finds the HG content in coals to range from 0.058-0.362 ppm per http://www.cement.org/bookstore/profile.asp?printpage=true&store=&id=13103
Hg in tires ranges from 0.1 to 0.2 ppm for TDF used at US kilns, according to the same report. Since Hg emissions decreased, perhaps the HG level in the TDF was lower than in the coal.

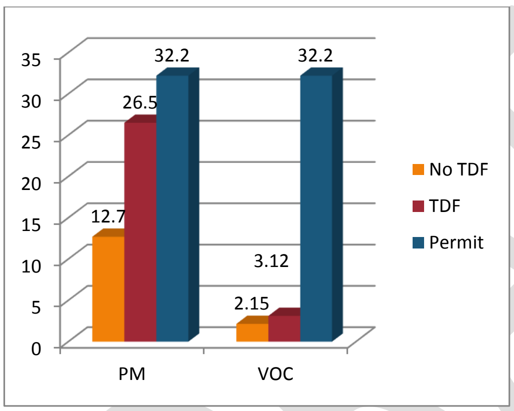


Figure 4: PM & VOCs in lbs/hr

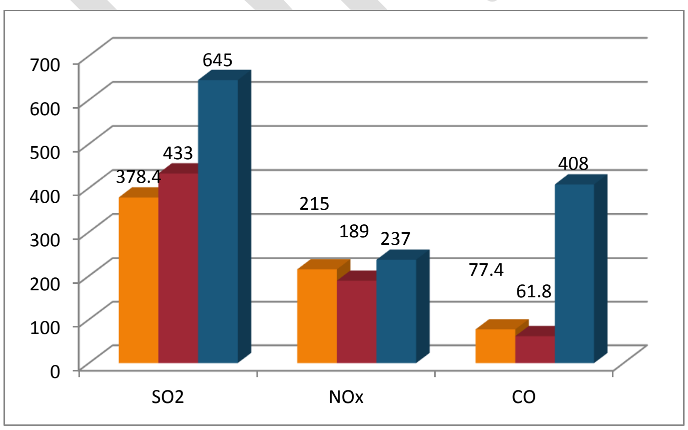


Figure 5: SO2, NOx & CO in lbs/hr

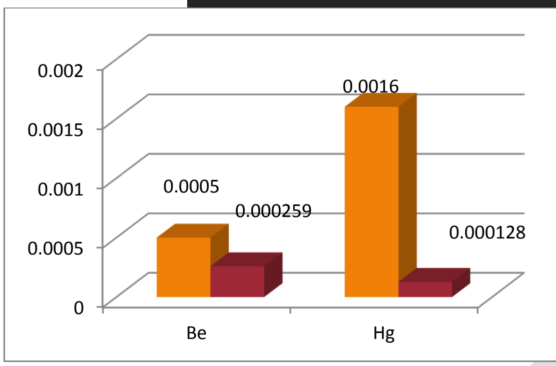


Figure 6: Beryllium & Mercury
in lbs/hr

The following figures show electric utility boiler "B" emissions when using TDF. "B" is located in the Midwest, uses up to 2.9% TDF mixed with high-sulfur coal and is a tangentially-fired cyclone boiler.

Figure 7 shows a slight increase in particulate matter, due to the more zinc present in TDF.

Figure 8 plots the decrease in sulfur emissions since TDF is lower in S than the high-sulfur coal used as base fuel. NOx is unchanged since the temperature of combustion is not substantially increased.

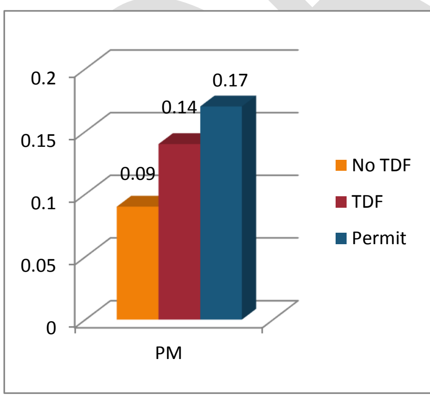


Figure 7: Particulate Matter
in lbs/MMBtu

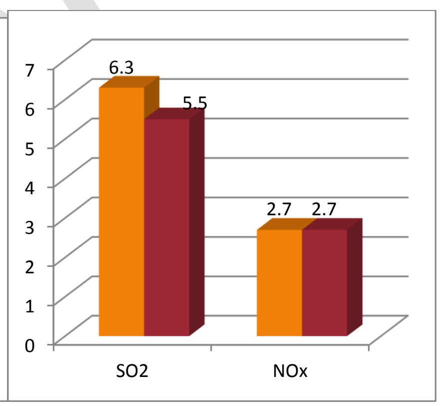


Figure 8: SO2 & NOx
in lbs/MMBtu

The following figures show electric utility boiler "C" emissions when using TDF. "C" is located in the Midsouth and uses coal.

Figure 9 shows a slight decrease in Dioxins/Furans as measured in 2,3,7,8 TCDD Equivalents, which is a unit used after converting each of the isomers of dioxins and furans into numerical toxicity equivalent units, using the most toxic isomer as the benchmark. According to Green Facts, TCDD or 2,3,7,8-TCDD is one of the most potent toxic dioxins and used as a reference for all other dioxins. 1,2,3,7,8-Pentachlorodibenzodioxin is of a similar potency, while the other members of the subset are 10–10,000 times less toxic.

Nationally, D/F generation seems more random with some going up and others down in different tests even at the same plant using the same TDF/fuel mix.

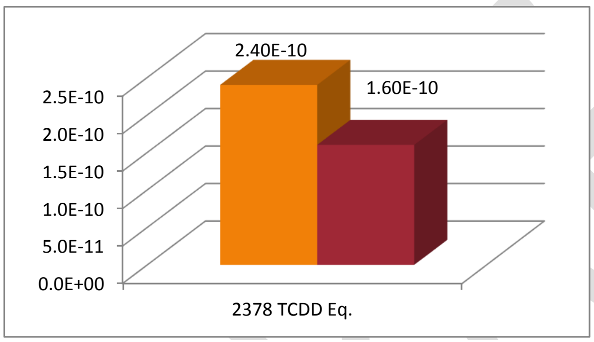


Figure 9: Dioxins/Furans in lbs/hr

Industrial/Institutional Boilers

Approximately 19 million tires per year are consumed in industrial boilers.

According to a Rubber Manufacturers Association survey in 2009, 22 industrial facilities were using TDF in their boilers to supplement their fuel usage. Industrial boilers are smaller than utility boilers and typically use a variety of fuels. When utilizing TDF, tires are typically shredded. Not all boilers are compatible with TDF. Clumping and clogging are common and preclude the use of TDF in many facilities.

Another impediment is the metal in the tires. If not removed before combustion, metal ends up in the ash and can create disposal problems. Each facility must evaluate the impact of TDF on their air emissions and ash disposal. Industrial facilities must apply for the appropriate permits from their state and/or local regulatory authorities before commencing operation.

Dedicated Tire-To-Energy Facilities

Approximately 16 million tires per year are consumed as fuel at dedicated tire-to-energy facilities. A dedicated tire-to-energy facility is specifically designed to burn TDF as its only fuel to create energy.

Even though dedicated tire-to-energy facilities have been demonstrated to achieve emission rates much lower than most solid fuel combustors, there are no known facilities under construction or consideration. The length of time and cost of construction, as well as the deregulation of the utility industry, hinders further expansion of this industry.

Tire-Derived Fuel Frequent Questions

Frequent Questions

1. Why use tires as fuel when there are other ways to recycle scrap tires?
2. What are the trends of scrap tires used as fuel versus other market applications?
3. What are the benefits of using tires as fuel?
4. How is TDF regulated prior to processing?
5. Have any standards been developed for the physical characteristics of TDF?

Question 1. Why use tires as fuel when there are other ways to recycle scrap tires?

Answer: Tire-derived fuel (TDF) was the first market for scrap tires and continues to be the largest market. From 1979 until 1992 TDF was the primary market for tires. Beginning in 1992, whole scrap tires were used as feedstock for ground rubber, and processed tires were used in civil engineering applications. Based on over 20 years of experience with more than 80 individual facilities, EPA recognizes that the use of tire-derived fuel is a viable alternative to the use of fossil fuels (see EPA's TDF factsheet (PDF) (1 pg, 12K, About PDF). In order to prevent tires from being stockpiled or disposed of in landfills, diverse markets need to be in place to handle the approximately 303 million scrap tires that are generated annually.

Scrap tire-derived fuel, or TDF, is used because of its high heating value. Compared to other commonly used solid fuels, the heating value is 25-50% higher than coal and 100-200% higher than wood. Facilities such as utility boilers, cement kilns, and pulp/paper mills use TDF as supplemental fuel in their energy-intensive processes. Furthermore, scrap tires that are removed from stockpiles only have two uses in the current markets: TDF and limited civil engineering applications.

Question 2. What are the trends of scrap tires used as fuel versus other market applications?

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Answer: In 1990, 25 million tires (which are about 11 percent of the total number of scrap tires generated) were used in TDF. This represented 98 percent of the market for scrap tires. Since 1992, the number of tires used as TDF has increased, but the percentage of the overall number of tires going to this market has decreased.

In 2009, 164 million tires were used as TDF, but represented only 54 percent of scrap tires going to market applications since other markets have developed.

Source: Rubber Manufacturers Association (RMA) EXIT Disclaimer
July 2004 RMA report "US Scrap Tire Markets - 2003 Edition." EXIT Disclaimer

Question 3. What are the benefits of using tires as fuel?

Answer: There are several benefits to using tires as fuel:

- Use of tire derived fuel (TDF) reduces the amount of fossil fuels that would otherwise be consumed.
- TDF is less expensive than fossil fuels.
- Diversion of tires from landfills where they interfere with MSW compaction equipment and helps prevent scrap tire piles. Scrap tire piles pose risks because they provide habitat for disease vectors (such as mosquitoes and rodents), and because they can catch fire, creating large amounts of toxic smoke and hazardous liquids that can contaminate air, water and soils.
- Some state agencies suggest that cement kilns add TDF to their coal fuel in order to decrease emissions of oxides of nitrogen (NOx).
- TDF offers the potential advantage of decreasing emissions of oxides of sulfur (SOx) when used to replace high sulfur coal in cement kiln applications.
- In cement kiln applications, the ash and metal resulting from TDF and coal combustion becomes an integral component of the product, eliminating the landfilling of ash and making this a sustainable process.

Question 4. How is TDF regulated prior to processing?

Answer: Day-to-day management of the collection of scrap tires is regulated at the state level. In 1985, Minnesota enacted the first state law for the management of scrap tires. According to 2007 RMA numbers, 46 states have enacted laws or regulations that address scrap tire management.

Question 5. Have any standards been developed for the physical properties of tire-derived fuel (TDF)?

Answer: Yes, in 2001, the American Society for Testing and Materials (ASTM) developed the following standard for shredded (not whole) tire derived fuel: "ACTIVE STANDARD: D6700-01 Standard Practice for Use of Scrap Tire-Derived Fuel."

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The following statement lists the scope of the TDF standard which is quoted from the ASTM website:

"1. Scope
1.1 This practice covers and provides guidance for the material recovery of scrap tires for their fuel value. The conversion of a whole scrap tire into a chipped formed for use as a fuel produces a product called tire-derived fuel (TDF). This recovery practice has moved from a pioneering concept in the early 1980s to a proven and continuous use in the United States with industrial and utility applications.

1.2 Combustion units engineered to use solid fuels, such as coal, wood, or both, are fairly numerous throughout the U.S. Many of these units are now using TDF even though they were not specifically designed to burn TDF. It is clear that TDF has combustion characteristics similar to other carbon-based solid fuels. Similarities led to pragmatic testing in existing combustion units. Successful testing led to subsequent acceptance of TDF as a supplemental fuel when blended with conventional fuels in existing combustion devices. The changes required to modify appropriate existing combustion units to accommodate TDF range from none to relatively minor. The issues of proper applications and specifications are critical to successful utilization of this alternative energy resource.

1.3 This practice explains TDF's use when blended and combusted under normal operating conditions with originally specified fuels. Whole tire combustion for energy recovery is not discussed herein since whole tire usage does not require tire processing to a defined fuel specification.

1.4 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use."

To access ASTM standards, visit the ASTM website. EXIT Disclaimer

Note: The answers to these questions were reviewed for technical accuracy by the TDF Committee of the Scrap Tire Workgroup

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Other Applications

http://www.epa.gov/epawaste/conserve/materials/tires/uses/other.htm

Whole Tires and Cut, Stamped, Punched Products, and Exported

Scrap tires may be recycled by cutting, punching, or stamping them into various rubber products after removal of the steel bead. Products include floor mats, belts, gaskets, shoe soles, dock bumpers, seals, muffler hangers, shims, and washers.

Whole tires may be recycled or reused as highway crash barriers, for boat bumpers at marine docks, and for a variety of agricultural purposes.

For additional information on reuse and recycling of scrap tires, see:

Comprehensive Procurement Guidelines (CPG)
The site includes EPA's list of designated products and the accompanying recycled-content recommendations. In order to find out some of the products that can be made from recovered scrap rubber, review the appropriate product guidelines such as floor tiles and patio blocks, playground surfaces, running tracks, and retreaded tires.

Environmentally Preferable Purchasing (EPP)
This Web site includes an online searchable database of environmental information for environmentally preferable products including tires and products made from recycled tires.

Product Stewardship/Extended Product Responsibility: Vehicles
Product stewardship is a product-centered approach to environmental protection. Also known as extended product responsibility (EPR), product stewardship calls on those in the product life cycle-manufacturers, retailers, users, and disposers-to share responsibility for reducing the environmental impacts of products.

Resale of used Tire or Retreading

Used tires that have minimal ware are sometimes reclaimed, resold and remounted. Also serviceable tires (used tries) can be retreaded. These tires are not scrap tires by definition since scrap tires can not be retreaded and thus retreads are not scrap tires. Retreading involves removing the outside, or tread, of the tire and adding a new tread. Retreading saves millions of gallons of oil each year, because it takes only 7 gallons of oil to retread a used tire compared to 22 gallons to produce a new tire.

Retread tires not only offer considerable environmental and economic benefits, but they also provide quality, comfort, and safety comparable to that of new

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tires. The demand for retreaded passenger tires has been decreasing for several decades due to innovations in tire design, safty, and economics.

The Tire Retread Information Bureau EXIT Disclaimer estimates that about 24 million tires are retread and sold each year in the US and Canada, combined. The Rubber Manufacturing Association estimates that in the US, about 16 million scrap tires were retreaded in 2001. Most are used by the trucking, aircraft, construction, and agriculture industries, and on US government vehicles. Benefits of retreading are that it:

- Saves resources by requiring 70% less oil for production,
- Contains 75% post-consumer material,
- Costs 30% to 70% less than making a new tire. and
- Saves landfill space.

Export

Two percent of the total tires consumed (102 tons) are exported. Additional a significant amount of the tires reclaimed from tire stockpiles are also exported. Many scrap tires are exported to foreign countries to be reused as retreads, especially in countries with growing populations of automobile drivers such as Japan and Mexico. According to Mexico's National Association of Tire Distributors, as many as 20% of tires sold in Mexico are imported as used tires from the US and then sold or retreaded for reuse. Some foreign countries also import tires to be shredded and used as crumb rubber, or to be used as fuel. Unfortunately, not all exported tires are reused or recycled. The downside of exporting scrap tires is that the receiving countries may end up with a disproportionate amount of tires, in addition to their own internally-generated scrap tires.

Other Possible Uses

These uses may require prior authorization in many states

- Erosion control/rainwater runoff barriers (whole tires)
- Wetlands/marsh establishment (whole tires)
- Crash barriers around race tracks (whole tires)
- Boat bumpers at marinas (whole tires)

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Scrap Tire Environmental Issues

Commented [MRS11]: New web page

http://www.epa.gov/epawaste/conserve/materials/tires/environ

Concerns have been raised over the health and safety issues associated with some applications of used tires. Tire Derived Fuel has been associated with air quality concerns. Civil Engineering applications, and rubberized asphalt have been associated with the possibility of ground water contamination, and the use of ground rubber in recreational and artificial playing surfaces has raised concerns about lead in synthetic turf. In an effort to address some of these concerns, EPA, is offering information on the following:

Burning Tire Piles

Tire Piles
Tire-Derived Fuel (TDF)
Civil Engineering Applications and Rubberized Asphalt
Ground Rubber in Synthetic Turf

Tire Piles

Tire piles-legal or illegal-pose two major health threats: pests and fire. A tire's physical structure, durability, make tire stockpiles a potential threat to human health and the environment. The curved shape of a tire allows rainwater to collect and creates an ideal habitat for rodents and mosquitoes. Disease carrying pests such as rodents may live in tire piles. Mosquitoes can also breed in the stagnant water that collects inside tires. Several varieties of mosquitoes can carry deadly diseases, including encephalitis and dengue fever. Mosquito control and eradication programs, short of removing tire piles, are difficult. For more information on mosquito-borne diseases, visit the Centers for Disease Control and Prevention.

Fire presents a second concern. Tires are prone to heat retention, but are not prone to ignite when left in sunlight

and have been known to ignite, creating tire fires that are difficult to extinguish and can burn for months, generating unhealthy smoke and toxic oils.. Tire fires generally start either as a result of lightning strikes, arson or accident. Once a tire fire occurs, tires break down into hazardous compounds including gases, heavy metals, and oil, which may then trigger Superfund cleanup status. Tire fires release thick black smoke and can contaminate the soil with an oily residue.

Illegal tire dumping pollutes ravines, woods, deserts, and empty lots. For these reasons, most states have passed scrap tire regulations requiring proper management.

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Tire-Derived Fuel (TDF)

Commented [MRS12]: Pending review by Terry Gray

Questions have been raised regarding air quality concerns associated with the burning of tires for fuel. Three frequently asked questions are addressed below.

- How do stack emissions vary from facilities that use tire-derived fuel (TDF) versus conventional fuels?
- What is the extent of dioxin/furan emissions from cement kilns or other facilities that use tire-derived fuel (TDF)?
- What are the emission and performance standards for facilities that use tire-derived fuel (TDF)?

Q: How do stack emissions vary from facilities that use tire-derived fuel (TDF) versus conventional fuels?

A: EPA and state testing has shown that TDF produces emissions comparable to other conventional fuels. At well controlled facilities, emissions will not change significantly when TDF is used to replace some of the typical fuel used at the facility. It is important to note that there are variations from test to test at plants that don't use TDF, even when every attempt is made to hold operating conditions constant. Facilities have to meet regulatory limits when they use this fuel or other fuels and must demonstrate through compliance testing that they are achieving the applicable emission limitations.

The following statement is from an EPA research paper on use of TDF: *"TDF can be used successfully as a 10-20% supplementary fuel in properly designed fuel combustors with good combustion control and add-on particulate controls, such as electrostatic precipitators, or fabric filters. Furthermore, a dedicated tire-to-energy facility specifically designed to burn TDF as its only fuel has been demonstrated to achieve emission rates much lower than most solid fuel combustors. No field data were available for well-designed combustors with any add-on particulate controls. Laboratory testing of a Rotary Kiln Incinerator Simulator (RKIS) indicated that efficient combustion of supplementary TDF can destroy many volatile and semi volatile air contaminants. However, it is not likely that a solid fuel combustor without add-on particulate controls could satisfy air emission regulatory requirements in the U. S".*

Source: *Air Emissions from Scrap Tire Combustion (PDF) (17 pp, 650K, About PDF), 1997*
The workgroup gathered stack test data from US plants using TDF and include it in a comprehensive database. Emission sampling results from one cement kiln showed that carcinogenic risk declined when TDF was burned as a fuel.

Q: What is the extent of dioxin/furan emissions from cement kilns or other facilities that use tire-derived fuel (TDF)?

A: For example, cement kilns accepting whole tires from waste piles must meet the limit for solid waste combustors of 0.13 nanograms per dry standard cubic meter (ng/dscm) TEQ (toxic equivalency basis). Combustors are units burning solid waste. Please see 40 CFR CCCC for the air emission regulation; and 40 CFR 241 Subparts A and B. Cement kilns accepting whole tires from retailers accompanied by a state manifest are subject to major source standards since such tires do not meet the Definition of a Solid Waste (DSW), and hence, the kiln does not require a solid waste combustor permit. A major source or industrial, commercial, or industrial boiler or process heater greater than 10 MMBtu/hr must not exceed 4 ng/dscm (TEQ) corrected to 7 percent oxygen or 9.2E–09 (TEQ) (lb per MMBtu of steam output). Please refer to 40 CFR 63 Subpart DDDDD. Most large industrial users of TDF are subject to this standard. Utilities are subject to a separate standard for air emissions at 40 CFR 63 Subpart UUUUU which does not specifically target dioxin/furans, but does specify limits for mercury and other parameters.

Dioxin/furan emissions at cement kilns are primarily a function of exhaust gas temperature in the air pollution control device, which is typically either a fabric filter or electrostatic precipitator. EPA has previously determined that the type of fuel used (e.g., coal vs. alternative fuels) likely does not affect

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dioxin/furan emission rates. Regardless of the fuel used, cement kilns must comply with stringent limits on dioxin/furan emissions (0.2 ng TEQ/dscm or 0.4 ng TEQ/dscm and limited air pollution control device inlet temperature)[1]. Dioxin/furan emissions at cement plants can vary widely within the allowable range, regardless of whether TDF is used. Limited data suggests that use of TDF in cement kilns does not adversely impact dioxin and furan emissions. Note that when comparing measured dioxin/furan emission rates from the same source (both with and without TDF), the differences in measured emissions may be more attributable to measurement sensitivities and/or test-to-test variations in the factors that influence measured dioxin/furan emissions and not due to the use of TDF itself.

[1] *ng = nanograms; TEQ = toxicity equivalent quotient, the international method of relating the toxicity of various dioxin/furan congeners to the toxicity of 2,3,7,8-TCDD; dscm = dry standard cubic meters*

Q: What are the emission and performance standards for facilities that use tire-derived fuel (TDF)?

A: Cement kilns emissions are controlled by several overlapping regulations. If the kiln accepts whole tires from tire pile cleanups, for example, the DSW rule at 40 CFR 241 labels it as a solid waste, and the kiln must have a solid waste combustor permit pursuant to 40 CFR 63 CCCC. If the kiln accepts shredded tires or whole tires from retailers accompanied by a state-approved manifest, then it could be a major area boiler under the slightly less stringent 40 CFR 63 UUUUU. The national emission standards for hazardous air pollutants (NESHAP) for the Portland Cement manufacturing industry (40 CFR 63 subpart LLL) apply to all Portland Cement kilns (including those that burn TDF) except for those that burn hazardous waste. The NESHAP includes emission limits and monitoring requirements for the following pollutants emitted from Portland Cement kilns: particulate matter (as a surrogate for hazardous air pollutants (HAP) metals), dioxins/furans, and total hydrocarbons (as a surrogate for organic HAPs, including polycyclic organic matter). Facilities must perform testing for these pollutants and must repeat the tests if any significant change is made to the raw material components or fuels fed to the kiln that could lead to an increase in emissions of dioxins/furans or particulate matter (e.g., when there is an increase in the input rate of TDF). This rule was promulgated in 1999, amended in 2002, and additional amendments were proposed in December 2005.

EPA amended the requirements with 6 actions to the NESHAP and to the New Source Performance Standards (NSPS) from May 6th, 2009 to November 8th, 2010. The final amendments to the NESHAP add or revise, as applicable, emission limits for mercury, total hydrocarbons (THC), and particulate matter (PM) from new and existing kilns located at major and area sources, and for hydrochloric acid (HCl) from new and existing kilns located at major sources. The standards for new kilns apply to facilities that commence construction, modification, or reconstruction after May 6, 2009.

The final amendments to the NSPS add or revise, as applicable, emission limits for PM, opacity, nitrogen oxides (NOx), and sulfur dioxide (SO2) for facilities that commence construction, modification, or reconstruction after June 16, 2008. The final rule also includes additional testing and monitoring requirements for affected sources.

Boilers that burn TDF at major source pulp and paper manufacturing facilities are subject to the NESHAP for Industrial, Commercial, and Institutional Boilers and Process Heaters (40 CFR 63 subpart DDDDD). See the *Federal Register* notice (September 13, 2004) for the final rule at 69 *FR* 55217. The NESHAP includes emission limits and monitoring requirements for particulate matter (as a surrogate for HAP metals) or total selected metals (fuel analysis for arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, and selenium), hydrogen chloride, and mercury. Facilities must perform testing for these pollutants and must repeat the tests if they plan to exceed the maximum fuel feed rate (set during the initial compliance test) of any of the solid fuels that are burned (e.g., when there is an increase in the input rate of TDF). This rule was promulgated in 2004 and amended in 2005.

Additionally, cement kilns and other manufacturers are subject to the greenhouse gas tailoring rule which is targeted for the largest 70% of greenhouse gas generators.

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Cement Kilns Standards website: http://www.federalregister.gov/articles/2010/09/09/2010-21102/national-emission-standards-for-hazardous-air-pollutants-from-the-portland-cement-manufacturing#p-3

Industrial/Commercial/Institutional Boilers standards website

http://www.epa.gov/airquality/combustion/actions.html

Regulations at:

40 CFR part 63 subpart LLL

40 CFR part 63, subpart DDDDD

For the Greenhouse Gas Rule Tailoring Rule Information, please refer to:

http://www.epa.gov/nsr/actions.html#may10

Scrap Tires in Civil Engineering Applications & Rubberized Asphalt Environmental Issues

Literature Review on Water Quality and Environmental Toxicology Effects of TDA
A literature review was conducted by the University of Maine on the water quality and environmental toxicology effects of tire-derived aggregate (TDA). The review found that: "TDA has a limited effect on drinking water quality and fresh water aquatic toxicity for a range of applications including lightweight backfill for walls and bridge abutments, insulation and drainage layers beneath roads, free-draining and insulating backfill for residential foundations, vibration damping layers beneath rail lines, landfill leachate collections systems, drainage layers in landfill caps, landfill gas collection systems, and drainage aggregate for drain fields for on-site waste water treatment systems. TDA is unlikely to increase the concentration of substances with primary drinking water standards above those naturally occurring in the groundwater. It is likely that TDA will increase the concentration of iron and manganese, but the data indicates that these elements have limited ability to migrate away from the TDA installation." This literature review was requested by the Scrap Tire Workgroup and was compiled by Dr. Dana Humphrey and Michael Swett of the University of Maine.
Literature Review of the Water Quality Effects of Tire Derived Aggregate and Rubber Modified Asphalt Pavement (PDF) (58 pp, 332K, About PDF)

- Potential for toxics to leach from tires when placed in wet soils. Several environmental studies have been performed to assess the potential for toxics to leach from tires when placed in wet soils. The impact of scrap tires on the environment varies according to the local water and soil conditions, especially pH value.
  Chelsea Center's Technical Report on Environmental Impacts of Rubber In Light Fill Applications (PDF) (20 pp, 153K, About PDF) EXIT Disclaimer

- Two studies by the University of Maine's Department of Civil Engineering on water quality of tire leachate below the ground water table showed that if the groundwater pH is near neutral (not too acidic or basic), tire shreds have only a small impact on groundwater quality.
  Field Study of Water Quality Effects of Tire Shreds Placed Below the Water Table (PDF) (10 pp, 183K, About PDF) EXIT Disclaimer

- Minnesota began using shredded tires as a lightweight fill material in 1985 on logging roads through areas with weak soils. This report documents seven sites in Minnesota that used shredded waste tires as lightweight fill. Shredded tires were proven to be a viable form of lightweight fill because they are relatively lightweight, inexpensive and non-biodegradable. (Please note that this report mentions pyrolysis as a potential market for scrap tires, but after many attempts, pyrolysis has never been proven to be economically viable in the US.)
  Using Shredded Tires as Lightweight Fill Material for Road Subgrades (PDF) (38 pp, 327K, About PDF EXIT Disclaimer

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- The Minnesota Department of Transportation Offices of Environmental Services conducted a two year study Of the Oak Grove Tire Shreds Project entitled Tire Shreds Below the Seasonal Groundwater Table Years 2006 - 2008 Final Report Dated October 2008. The final report contains 13 appendixes' documenting all aspects of the work and the results.

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Ground Rubber in Artificial Sports Fields

Concerns regarding user health and environmental issues from using ground rubber in artificial turf and playgrounds have been raised by a number of individuals and organizations. The Office of Research and Development NERL conducted a literature search that revealed limited environmental or exposure measurement data associated with the use of tire crumb rubber for recreational fields. Only a few peer reviewed laboratory or environmental studies were reported, with many of these studies conducted in Europe. Although the results were limited, the search identified a number of compounds and metals that *may* be found in tires, although not all of these compounds and metals are contained in every tire nor are they contained in the same concentration in any tire at any given time. Compounds and metals that may be found to be contained in tires include:

Acetone	Aniline	Benzene
Benzothiazole	Chloroethane	Halogenated flame
retardants	Isoprene	Methyl ethyl ketone
Methyl isobutyl ketone	Naphthalene	Phenol
Polycyclic aromatic	hydrocarbons	Styrene-butadiene
Toluene	Trichloroethylene	Arsenic
Barium	Cadmium	Chromium
Cobalt	Copper	Lead
Manganese	Mercury	Nickel
Sulfur	Zinc	Pigments
Nylon	Polyester	Rayon
Latex		

In response to concerns about potential risks resulting from the use of recycled tire crumb in playgrounds and in conjunction with synthetic turf athletic fields, EPA conducted a Scoping-Level Field Monitoring Study of Synthetic Turf Fields and Playgrounds. The final report was issued in 2009 (http://www.epa.gov/nerl/features/tire_crumbs.html) and concluded that on average, concentrations of components monitored in this study were below levels of concern. To supplement this study's limited data, EPA met with state and local representatives in 2010 to review other available field monitoring studies including a recent study conducted by the state of Connecticut (www.ct.gov/dep/artificialturf) which concluded that exposures and risks were not elevated (relative to what is commonly found in outdoor air) for either children and adults using the fields. According to a recent California report (http://www.calrecycle.ca.gov/publications/tires/2011007.pdf) that looks into the possible human health risks of outdoor athletic fields made from artificial turf containing recycled crumb rubber with respect to skin abrasions, bacteria harbored by the turf, inhalable particulate matter, and volatile organic compounds, it was concluded that these fields do not pose a serious public health concern, with the possible exception of an increased skin abrasion rate on artificial turf relative to natural turf.

At this point in time, we do not believe that the field monitoring data collected to date by EPA and others provides evidence of an elevated health risk resulting from the use of tire mulch in playgrounds or synthetic turf athletic fields. Ultimately, the use of tire crumb or any other playground materials is a local or state decision.

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The biggest issue raised regarding safety was whether chemicals used in the manufacture of tires find their way into the bodies of users either via ingestion or by breathing any fumes. It was found that the chemicals, including latex, used to manufacture tires, are rendered virtually inert by the heat and pressure process used to cure the rubber. The biggest concern raised about environmental issues was whether zinc compounds leaching from tires can contaminate ground and surface water. It was found that very little zinc leaches from the rubber and that which does escape quickly binds with organic compounds found naturally in the vicinity causing no further issues. It was found that in most cases air emissions from the fields resulted in no findings greater than background levels for significant contaminants. Numerous studies conducted by government and industry groups indicate that ground rubber does not contribute to either user safety or environmental issues.

The single remaining issue is heat retention in the field itself. It was found that ground rubber is a nearly insignificant contributor to this effect. The artificial turf "carpet" itself is the primary insulator retaining heat. Athletes and other users of artificial turf should monitor their body temperatures and hydrate appropriately just as they should while using any other playing surface. Some field owners have found that they can mitigate heat by watering their fields just prior to use.

References:

- Connecticut Department of Environmental Protection: Risk Assessment of Artificial Turf Fields EXIT Disclaimer- results of a two-year comprehensive evaluation of the health and environmental impacts associated with artificial turf fields containing crumb rubber infill.
- A Scoping-Level Field Monitoring Study of Synthetic Turf Fields and Playgrounds" (PDF) (123pp, 7.2MB, about PDF) - limited EPA study finds low level of concern in samples of recycled tires from ballfield and playground surfaces
- The Use of Recycled Tire Materials on Playgrounds & Artificial Turf Fields - fact sheet summarizing the above study
- Evaluation of Health Effects of Recycled Waste Tires in Playground and Track Products. Developed for the California Integrated Waste Management Board
- Study Finds Crumb Rubber Turf Poses No Significant Threat To Air/Water Quality: Tests Show No Health Concerns at Synthetic Turf Fields EXIT Disclaimer
- A Study to Assess Potential Environmental Impacts from the Use of Crumb Rubber as Infill Material in Synthetic Turf Fields (PDF) (29 pp, 83K, about PDF) EXIT Disclaimer- prepared by the the New York State Department of Environmental Conservation and Department of Health, provides details of the study plan
- Fact Sheet: Crumb-Rubber Infilled Synthetic Turf Athletic Fields EXIT Disclaimer
- An Assessment of Chemical Leaching, Releases to Air and Temperature at Crumb-Rubber Infilled Synthetic Turf Fields (PDF) (140 pp, 966K, about PDF) EXIT Disclaimer- final study.

There is no single location to find all the studies that have been completed. The most complete listings can be found in the "Research and Latest Thinking" section of the Synthetic Turf Council website: http://www.syntheticturfcouncil.org/ and in the "Publications" section of the Rubber Manufacturers website: http://www.rma.org/

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Additional Crumb Rubber Toxicology References

July 2010 Connecticut Department of Energy & Environmental Protection, Risk Assessment of Artificial Turf Fields. The report is a compilation of four separate state agency reports (UCHC, CAES, DPH, DEP) completed a two year comprehensive evaluation of health and environmental impacts associated with artificial turf fields containing crumb rubber infill. www.ct.gov/dep/artificialturf

12/10/2009 U.S. EPA Office of Research and Development NERL, Limited EPA Study Finds Low Level of Concern in Samples of Recycled Tires from Ballfield and Playground Surfaces. Study Http://www.epa.gov/nerl/features/tire_crumbs.html

03/2009 Vetrano, NYCDOHMH, Air Quality Survey of Synthetic Turf Fields Containing Crumb Rubber Infill. Study http://www.nyc. gov/html/doh/downloads/pdf/eode/turf_ aqs_report0409.pdf

05/2009 NYSDECNYSDH, An Assessment of Chemical Leaching, Releases to Air and Temperature at Crumb Rubber Infilled Synthetic Turf Fields Study on Leachate. Literature review http://www.nyc.gov/html/doh/downloads/pdf/eode/turf report 05-08.pdf Study www.dec.ny.gov/docs/materials minerals_pdf/crumbrubfr.pdf

07/2009 New York City Department of Health and Mental Hygiene: Fact Sheet on Synthetic Turf Used in Athletic Fields and Play Areas: Questions and Answers Regarding Artificial Turf. http ://www.nyc. gov/html/doh/html/eode/eode-turf. Shtml

06/2009 Charles Vidair, Office of Environmental Health Hazard Assessment, CAEPA Chemicals and particulates in the air above the new generation of artificial turf playing fields, and artificial turf as a risk factor for infection by methicillin-resistant Staphylococcus aureus (MRSA) Literature review and data gap identification, https ://imageserv2 .team-logic, corn/.../CA OEHHA lit review re air quality and staph FULL RPT 10-19-09.pdf

Date Unknown 2008 NYSDECDSHM Crumb-Rubber Infilled Synthetic Turf Field Study Fact Sheet www.dec.nv.gov/docs/materials_minerals_pdf/crumbfacts.pdf

05/2008 NYCDOHMH, A Review of the Potential Health and Safety Risks from Synthetic Turf Fields Containing Crumb Rubber. www2.team-logic.com/.../7%20Pages%20from%207%20NYC%20DOH%20ExecSummaryOnlv%20-...

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08/2008 New York State Department of Health: Fact Sheet on Crumb Rubber Used as Infill Material in Athletic Fields in Synthetic Turf Fields, http://www.asgi.us/xwp/2008/08/18/ny-dept-of-health-082008-publishes-fact-sheet-on-synthetic-turf-fields

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www2.teamloeic.com/.../4%20Milone%20MacBroom%20Studv%202008.pdf Toxicity from Exposure to Crumb Rubber.
www2.teamlogic.com/…/12%20NJDEP%20White%20Paper%20%20Crumb%20Rubber%20%20JUNE2007.pdf

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10/2007 Connecticut Department of Public Health Fact Sheet on Artificial Turf Fields.
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Crumb Rubber Safety References

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ASTM Designation F 1292-04, Standard Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment.

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06/18/2008 Disease Control and Prevention. CDC Health Advisory. Potential exposures to lead in artificial turf: Public health issues, actions, and recommendations CDCAN-00275-2008-06-18-ADV-N. Available at http://www2a.cdc.gov/HAN/ArchiveSys/ViewMsgV.asp?AlertNum=00275

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Wastes Home

Resource Conservation Home

Common Wastes and Materials Home

Scrap Tires Home

Basic Information

Uses

Environmental Issue

Laws/Statues

Where You Live

Grants/Funding

Science/Technology

Publications

Scrap Tire Workgroup

Information Resources

Laws & Regulations

Educational Materials

Partnerships

Laws/Statutes

http://www.epa.gov/epawaste/conserve/materials/tires/laws.htm

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State and Local Governments

Scrap tires, as a solid waste, are regulated primarily by state governments. In 1985, Minnesota was the first state to enact scrap tire management laws. Currently, 48 states have laws or regulations specifically dealing with scrap tires. While each state has its own program, some common features include:

The City of Modesto Amnesty Program allows Modesto, California residents the opportunity to drop-off waste tires for recycling at no charge. Tires of all sizes are accepted.

- a source of funding for the program via taxes or fees on automobiles or tires;
- licensing or registration requirements for scrap tire haulers, processors and some end users;
- manifests for scrap tire shipments;
- limitations on who may handle scrap tires;
- financial assurance requirements for scrap tire handlers, storage facilities, processor, and disposal facilities and
- market development activities.

Local municipalities help educate the public about illegal dumping and enforce anti-tire dumping laws. Local agencies are usually responsible for tire pile cleanup. Some local jurisdictions encourage proper disposal by allowing local citizens to drop off limited numbers of tires at recycling centers, or conduct tire amnesty days where any local citizen can bring a limited number of tires to a drop-off site free of charge. State scrap tire programs may provide financial help to fund such events. Local municipalities also play big role in procuring products made with scrap tires including playground/park applications. In many states, local government agencies are also large users of rubberized asphalt in public paving projects. The Federal government is also a large purchaser of products made with recycled rubber, and has established purchasing guidelines.
For more information about state scrap tire programs, consult EPA's State Scrap Tire Reference Guide (PDF) (53 pp, 262K, About PDF

Each state makes its own scrap tire laws and regulations. These laws typically set the stage for rules for scrap tire hauling, storage, collection, processing, and use as well as establishing funding needed to support these activities. States also establish programs to clean up old scrap tire stockpiles. More information about state tire programs.

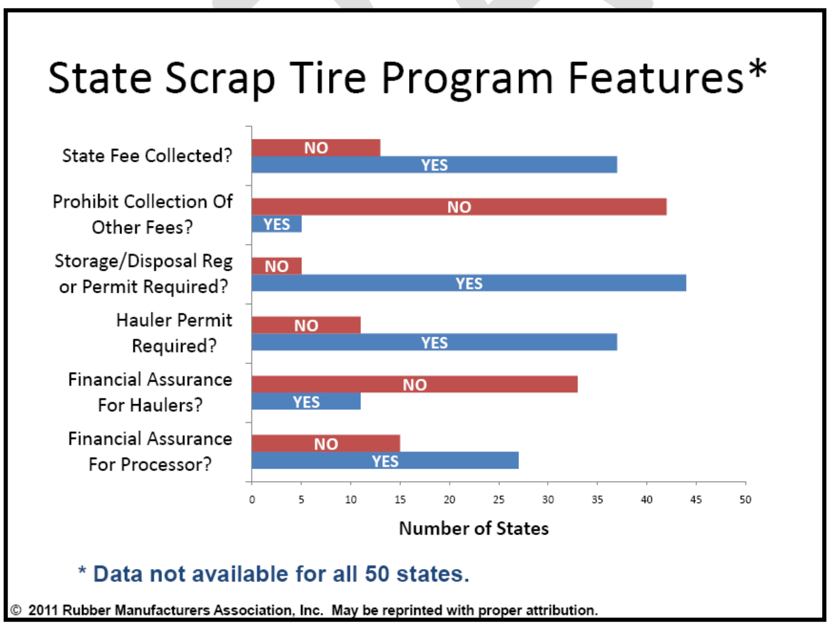
In recent years, scrap tire legislation has been a priority in many states. This is an indication that the majority of legislatures recognize that creating viable markets for scrap tires is an integral component of each state's environmental and recycling policies.

Tire Fees
Many states collect fees to fund scrap tire management programs or stockpile cleanups. Tire fees are typically assessed on the sale of new tires or on vehicle registrations. Fees generally range from $0.50 to $2 per passenger car tire, and truck tire fees range from $3 to $5. Some scrap tire fees also help local communities establish market programs, create licensing/enforcement systems, and host tire collection programs/amnesty events. States and municipalities may also use money generated by scrap tire fees to offer grants or loans to scrap tire processors and end users of tire-derived materials.

CalRecycle's Five-Year Plan Goals.

Currently, CalRecycle is focusing its efforts on:

- Promoting the development of long-term, sustainable and diversified markets for tire-derived products;
- Promoting the development of a long-term, sustainable supply infrastructure in California that efficiently and profitably produces high-quality raw material to meet market demand;
- Fostering information flow, knowledge transfer, and technology and product development to increase tire-derived product demand and the supply that feeds it, and
- Providing a strong and fair regulatory framework to protect public health and safety and the environment while not stifling waste tire flow and processing



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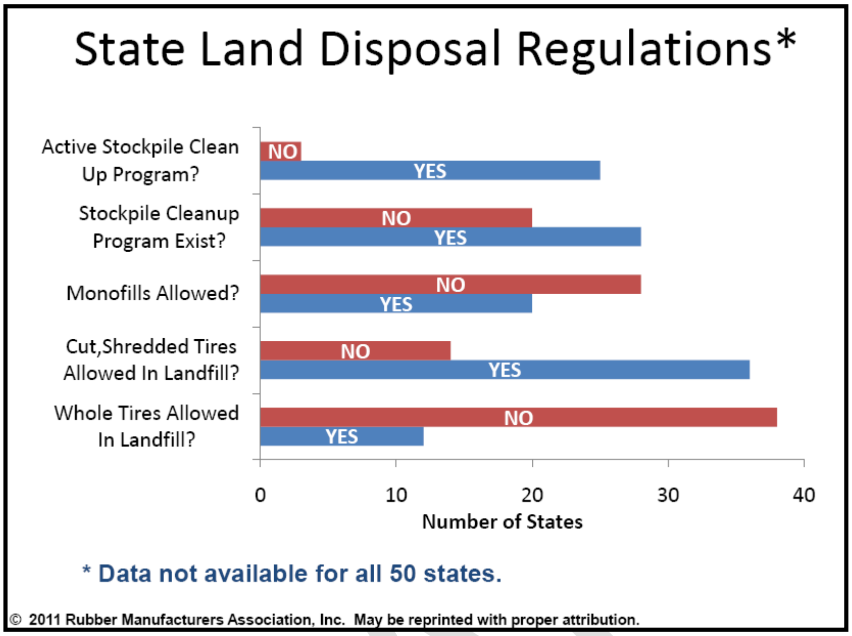

Additional Information

- State Scrap Tire Programs – A Quick Reference Guide: 1999 Update (53 pp, 262K, About PDF)
- Rubber Manufacturers Association Table of State Legislation of Scrap Tires EXIT Disclaimer
- Rubber Manufacturers Association State Scrap Tire Fees and Point of Collection EXIT Disclaimer

New Links for "Statutes and Laws"

A. Region I
  1. ME:
  2. MA:
  3. NH: http://des.nh.gov/organization/commissioner/legal/index.htm
  4. RI SW Rules: http://www.dem.ri.gov/programs/benviron/waste/topicsol.htm
     Statutes: http://www.rilin.state.ri.us/statutes/statutes.html

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Commented [MRS15]: Website Editor Note New State Law and Statutes links to be added

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5. VT Rules:
http://www.anr.state.vt.us/dec/wastediv/regulations.htm
Statutes: http://www.leg.state.vt.us/statutesMain.cfm

B. Region II
1. NJ: http://www.state.nj.us/dep/dshw/recycling/rule_link.htm
2. NY: http://www.dec.ny.gov/chemical/8792.html

C. Region III
1. DE:
http://www.delcode.delaware.gov/title7/c060/sc02/index.shtml
2. PA:
http://www.portal.state.pa.us/portal/server.pt/community/waste_tire_program/14097/home_%282%29/589696
3. MD regulations (Search for 26.04.08):
http://www.dsd.state.md.us/comar/SearchTitle.aspx?scope=26
Statutes: http://www.lexisnexis.com/hottopics/mdcode/
4. VA Tire: http://www.deq.virginia.gov/wastetires/homepage.html
Statutes: http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+TOC
Regulations: None
5. WV litter control:
http://www.dep.wv.gov/dlr/reap/tires/Pages/default.aspx
Statutes: http://www.legis.state.wv.us/WVCODE/Code.cfm
Regulations:
http://www.dep.wv.gov/WWE/regulations/Pages/default.aspx

D. Region IV
1. AL Description:
http://www.adem.state.al.us/programs/land/default.cnt
ADEM Rules:
http://www.alabamaadministrativecode.state.al.us/docs/adem/index.html
Statutes (search for "tire"):
http://www.alabama.gov/sliverheader/Welcome.do?url=http://www.legislature.state.al.us/ALISNetHome.html
2. FL SW Rules:
http://www.dep.state.fl.us/waste/quick_topics/rules/default.htm
Statutes (search for "tire"):
http://www.leg.state.fl.us/Statutes/index.cfm?Mode=Search%20Statutes&Submenu=2&Tab=statutes&CFID=228122558&CFTOKEN=36096631
3. GA Rule: http://rules.sos.state.ga.us/docs/391/3/4/19.pdf
Rules & Statutes:
http://www.gaepd.org/Documents/rules_exist.html

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4. KY Statutes: http://www.lrc.ky.gov/KRS/224-50/CHAPTER.HTM
(No regulations)
5. MS tire:
http://www.deq.state.ms.us/MDEQ.nsf/page/SW_Waste_Tire_Program_Information_And_Application_Forms?OpenDocument
Statutes:
http://www.mscode.com/free/statutes/17/017/0407.htm
6. NC Rules:
http://portal.ncdenr.org/c/journal/view_article_content?groupId=38361&articleId=332670&version=1.0
Statutes:
http://www.ncga.state.nc.us/EnactedLegislation/Statutes/HTML/ByChapter/Chapter_130A.html
7. SC Regulation:
http://www.scdhec.gov/environment/lwm/regs/R61-107_3.pdf
S.C. Code (Section 44-96-170):
http://www.scstatehouse.gov/code/t44c096.htm
8. TN Regulations (Search for "tire"):
http://tn.gov/sos/rules/1200/1200-01/1200-01-07.pdf
Statutes: http://www.lexisnexis.com/hottopics/tncode/
SW Rules:
Statutes:
Report:

Wastes Home

Resource Conservation Home

Common Wastes and Materials Home

Scrap Tires Home

Basic Information

Uses

Environmental Issue

Laws/Statues

Where You Live

Grants/Funding

Science/Technology

Publications

Scrap Tire Workgroup

Information Resources

Laws & Regulations

Educational Materials

Partnerships

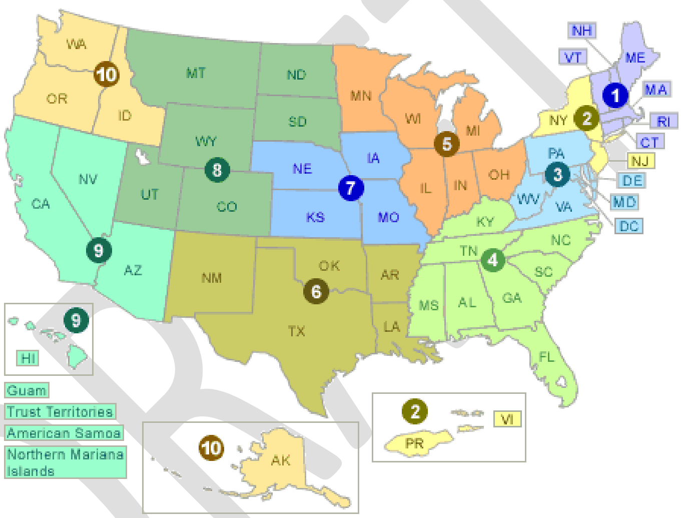
Where You Live

http://www.epa.gov/epawaste/conserve/materials/tires/live.htm

Choose your region or state from the map below or scroll down to find information about regional and state scrap tire programs. Also consult EPA's Quick Reference Guide to State Scrap Tire Programs (PDF) (53 pp, 262K, About PDF) which summarizes state scrap tire regulations and programs.

Commented [MRS16]: Website Editor Note: Check and update the links as necessary to ensure that they are correct with the file at the end of this section.

Note: If there is an Exit EPA sign after a state name below, then the link will take you directly to a page related to scrap tires. If there is no Exit EPA sign, then the link will take you to a site with links to state pages pertaining to waste management, solid waste, or municipal solid waste.



Region 1

The states of Connecticut, Maine, Massachusetts, New Hampshire, and Rhode Island have all enacted legislation specific to scrap tires. Although Vermont has no legislation specific to tires, the state is actively working to find innovative uses for scrap tires (including riverbank and slope stabilization, septic systems, and lightweight fill projects) and addresses scrap tire management as part of other environmental legislation. The state of Maine established an aggressive stockpile abatement program in 1996, and since then, they have removed over seven million tires from stockpiles and directed them to beneficial uses.

Connecticut EXIT Disclaimer

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Maine EXIT Disclaimer

Massachusetts

New Hampshire

Rhode Island EXIT Disclaimer

Vermont

Region 2

Both New Jersey and New York are working to expand markets for scrap tires. In New York, representatives from the scrap tire industry, scrap tire end users, and others formed a roundtable group to develop both short-and long-term market development programs. The NJ DOT has conducted several demonstration projects that utilize various mixes of rubber-modified asphalt.

New Jersey EXIT Disclaimer

New York EXIT Disclaimer

Region 3

The states of Pennsylvania, Maryland, and Virginia have strong scrap tire management programs. In West Virginia, the state DOT administers the Scrap Tire Cleanup Fund which comes from a $5 fee on all new automobile registrations. Delaware has no scrap tire legislation; however, tires are being managed as either a solid waste or recyclable material under existing solid waste regulations.

Delaware

Pennsylvania EXIT Disclaimer

Maryland EXIT Disclaimer

Virginia EXIT Disclaimer

West Virginia

Region 4

Many of the states in Region 4 are actively implementing innovative uses for scrap tires. The state of Florida has been a leader in the use of asphalt rubber for use in highway pavement. Alabama, Florida, Georgia, and South Carolina allow tire shreds to be used in

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construction of drain fields for septic systems. Kentucky has used tires funds for market development including expanded use of tire derived fuel. In Tennessee, each county receives $70 per ton for waste tires collected and sent to beneficial use through the state's Waste Tire Grant Fund. Both Mississippi and North Carolina administer funds to improve the use of recycled products, including tires.

Alabama

Florida EXIT Disclaimer

Georgia

Kentucky EXIT Disclaimer

Mississippi

North Carolina

South Carolina

Tennessee EXIT Disclaimer

Region 5

The states in Region 5 are actively addressing scrap tire management. Minnesota and Wisconsin were early leaders in the development of scrap tire management and disposal programs. The Illinois EPA established a Used Tire Program that funds over 100 waste tire cleanups throughout the state each year. Indiana, Michigan, and Ohio have all developed scrap tire market development programs and financial incentives for products made from recycled scrap tires.

Illinois EXIT Disclaimer

Indiana EXIT Disclaimer

Michigan EXIT Disclaimer

Minnesota EXIT Disclaimer

Ohio EXIT Disclaimer

Wisconsin EXIT Disclaimer

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Region 6

EPA Region 6 is aggressively working with the states to address illegal dumping of tires along the U.S./Mexico border in Texas and New Mexico. Both Arkansas and Louisiana provide financial incentives to reuse or recycle scrap tires. Arkansas offers a 30 percent tax credit on the purchase and installation of recycling equipment, including equipment for processing tires. Oklahoma is finding new, innovative uses for scrap tires including the use of tires in riverbank stabilization projects.

Arkansas EXIT Disclaimer

Louisiana EXIT Disclaimer

New Mexico

Oklahoma

Texas EXIT Disclaimer

Region 7

All the states in Region 7 ban whole tires from disposal in landfills and have enacted rules and regulations to ensure the proper management of scrap tires. Iowa's Waste Tire End Users Incentives Program provides up to $10 per ton to end users of processed waste tire products to increase end uses/markets for processed waste tire materials including the purchase of tire derived fuel, crumb rubber, or shredded tires for civil engineering uses. Nebraska and Missouri also provide grants to users of scrap tires and tire derived products. The state of Kansas provides funds for the development of waste tire recycling markets.

Iowa EXIT Disclaimer

Kansas EXIT Disclaimer

Missouri EXIT Disclaimer

Nebraska

Region 8

All the states in Region 8 have enacted scrap tire management programs to ensure the proper management of scrap tires through collection, transportation, storage, and/or processing of scrap tires. Utah and Colorado also provide end user incentives and market incentives, while the state of Montana provides tax credits for the procurement of recycled products. South Dakota provides funding for recycling end uses, including tire derived fuel programs. South Dakota DOT is developing civil engineering applications for shredded tires.

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Colorado

Montana EXIT Disclaimer

North Dakota

South Dakota EXIT Disclaimer

Utah EXIT Disclaimer

Wyoming

Region 9

California and Arizona use the most asphalt rubber in highway construction (over 80% of asphalt rubber utilized). Both Hawaii and Nevada provide financial incentives to state agencies for purchasing products made with recycled materials, including retread tires.

Arizona

California EXIT Disclaimer

Hawaii

Nevada

Region 10

The states in Region 10 have enacted regulations designed to prevent problematic storage and disposal of tires. Oregon and Washington have established disposal laws that regulate how tires are collected and stored. Oregon's regulations are also designed to encourage alternatives to disposal. In 2003, Idaho strengthened its Waste Tire Act by adding new provisions to allow the state, counties, and cities to regulate waste tire storage and disposal sites, and find additional methods for recycling/reusing tires. Alaska has no scrap tire legislation; however, the Alaskan DOT was the first in the US to field test rubberized asphalt.

Alaska

Idaho EXIT Disclaimer

Oregon EXIT Disclaimer

Washington

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Scrap Tire Workgroup “Where You Live:” New links

Commented [MRS17]: Note to Website Editor replace the old links on the: “Where you live” page with the current link below.

A. Region I

1. ME tire: http://www.maine.gov/dep/waste/solidwaste/scraptireab.html
   Reporting: See Solid Waste Annual Reporting at Rule-Chapter 402-Transfer Stations and Storage Sites for Solid Wastes on above web site
   Manifest: http://www.maine.gov/dep/waste/transpinstall/nonhaztransp.html
   Grants: None
   DEP: http://www.maine.gov/dep/index.shtml
2. MA SW: http://www.mass.gov/dep/recycle/index.htm
   Reporting: Recycling processor at http://www.mass.gov/dep/recycle/approvals/procinfo.pdf
   Manifest: None
   Grants: Credits at http://www.mass.gov/dep/service/regulations/310cmr17.pdf
   Program Report: None
   DEP: http://www.mass.gov/dep/
3. NH Tire: http://search.nh.gov/des-search.htm?cc=1&URL=http:%2F%2Fdes.nh.gov%2Forganization%2Fdivisions%2Fwaste%2Fswmb%2Fmanagement.htm&q=tire&wm=wrd
   Reporting: None
   Manifest: None
   Grants: http://des.nh.gov/organization/divisions/waste/swmb/categories/grants.htm
   Program Report: None
   DES: http://des.nh.gov/
4. RI SW: http://www.dem.ri.gov/programs/benviron/waste/topicsol.htm
   Reporting: http://www.dem.ri.gov/pubs/ar/demrep99/livable.htm
   Manifest: None
   Grants: See Brownfields at http://www.dem.ri.gov/brownfields/default.htm
   Program Report: None
   DEM: http://www.dem.ri.gov/
5. VT tire: http://www.anr.state.vt.us/dec/wastediv/HHW/tires.htm
   Reporting: None
   Manifest: None
   Grants: http://www.anr.state.vt.us/dec/wastediv/grants.htm
   Program Report: Salvage yards at http://www.anr.state.vt.us/dec/co/enf/pdf/Salvage%20Yard%20Report%202010.pdf
   Tires in Liter at http://www.anr.state.vt.us/dec/wastediv/r3/documents/WasteCompositionStudyReport.pdf
   ANR: http://www.anr.state.vt.us/

B. Region II

1. NJ tire: http://www.state.nj.us/dep/dshw/recycling/materialsinfo.htm#t
   Reporting: Daily Records & Quarterly SW Transportation at http://www.state.nj.us/dep/dshw/resource/2009%20RULES/26%20CHAPTER%203.pdf
   SW Facility Quarterly at http://www.state.nj.us/dep/dshw/resource/2009%20RULES/26%20CHAPTER%202B.pdf
   Manifest: None
   Grants: None
   Program Report: None
   DEP: http://www.state.nj.us/dep/
2. NY tire: http://www.dec.ny.gov/chemical/8792.html
   Reporting: http://www.dec.ny.gov/docs/materials_minerals_pdf/tireannrt.pdf

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Manifest: None
Grants: http://esd.ny.gov/businessprograms/environmentalassistance.html
Program Report: http://www.dec.ny.gov/chemical/9080.html
DEC: http://www.dec.ny.gov/index.html

C. Region III

1. **DE tire:** http://www.dnrec.delaware.gov/whs/awm/Info/Pages/ScrapTire.aspx
   Reporting: None
   Manifest: None
   Grants: None
   Program Report: None
   DNREC: http://www.dnrec.delaware.gov/Pages/AboutAgency.aspx
2. PA Tire:
   http://www.portal.state.pa.us/portal/server.pt/community/waste_tire_program/14097/home_%282%29/589696
   Reporting: http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-9027
   Manifest: None
   Grants: See "Statutes and Regulations" on above site.
   Program Report:
   http://jsg.legis.state.pa.us/resources/documents/ftp/publications/2007-29-Tire%20Report%20III.pdf
   DEP: http://www.portal.state.pa.us/portal/server.pt/community/dep_home/5968
3. MD tire:
   http://www.mde.maryland.gov/programs/land/recyclingandoperationsprogram/scraptire/pages/programs/landprograms/recycling/scraptire/index.aspx
   Reporting:
   http://www.mde.maryland.gov/programs/Land/SolidWaste/ApplicationsFormsandInstructions/Pages/Programs/LandPrograms/solid_waste/forms/index.aspx
   Manifest: None
   Grants:
   http://www.mde.maryland.gov/programs/Land/RecyclingandOperationsprogram/ScrapTire/Pages/programs/landprograms/recycling/scraptire/projects.aspx
   Program Report:
   http://www.mde.maryland.gov/programs/Land/RecyclingandOperationsprogram/StateAgencyRecycling/Documents/FY%2010%20Scrap%20Tire%20Report_FINAL.PDF
   DEP: http://www.mde.state.md.us/Pages/Home.aspx
4. **VA tire**: http://www.deq.virginia.gov/wastetires/homepage.html
   Reporting: None, other than End User Reimbursement
   Manifest: Waste tire certification, see
   http://www.deq.virginia.gov/wastetires/progsummary1.html
   Grants: http://www.deq.virginia.gov/wastetires/progsummary1.html
   Program Report:
   http://www.deq.virginia.gov/export/sites/default/recycle/WasteTirePileReportNovember2011.pdf
   DEQ: http://www.deq.virginia.gov/
5. WV tire: http://www.dep.wv.gov/dlr/reap/tires/Pages/default.aspx
   Reporting: None
   Manifest: none
   Grants: See tire website
   Program Report:
   http://www.dep.wv.gov/pio/Documents/09%20Annual%20Report%20Accomplishments.pdf
   DEP: http://www.dep.wv.gov/Pages/default.aspx

D. Region IV

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1. AL tire: http://www.adem.state.al.us/programs/land/scrapTire.cnt
   Reporting: http://www.adem.alabama.gov/DeptForms/Form539.pdf
   Manifest: http://www.adem.alabama.gov/DeptForms/Form536.pdf
   Grants:
   Program Report:
   ADEM: http://www.adem.state.al.us/default.cnt
2. FL tire: http://www.dep.state.fl.us/waste/categories/tires/default.htm
   Reporting: http://www.dep.state.fl.us/waste/categories/tires/default.htm
   Manifest: None
   Grants: http://www.dep.state.fl.us/waste/quick_topics/forms/documents/62-716/716_3.pdf
   Program Report:
   http://www.dep.state.fl.us/waste/quick_topics/publications/shw/tires/2009_Tires_State-of-the-State.pdf
   DEP: http://www.dep.state.fl.us/
3. GA tire: http://www.gaepd.org/Documents/regcomm_lpb.html#st
   Reporting: None
   Manifest: None
   Grants:
   http://dca.state.ga.us/development/research/programs/downloads/2007GrantsAndLoans.pdf
   Program Report: None
   EPD: http://www.gaepd.org/
4. KY tire: http://waste.ky.gov/RLA/Waste%20Tires/Pages/default.aspx
   Reporting: None
   Manifest: http://www.lrc.ky.gov/KRS/224-50/874.PDF
   Grants: http://waste.ky.gov/RLA/grants/Pages/default.aspx
   Program Report: See "Waste Tire Report" on tire webpage
   DEP: http://dep.ky.gov/Pages/default.aspx
5. **MS tire:** http://www.deq.state.ms.us/wastetire
   Reporting: See tire webpage
   Manifest: Contact tire program
   Grants: See tire webpage
   Program Report: See tire webpage
   DEQ: http://www.deq.state.ms.us/
6. **NC tire:** http://portal.ncdenr.org/web/wm/sw/scraptires
   Reporting: http://portal.ncdenr.org/web/wm/sw/swmar See Chapter 4 of FY 2010-11
   Manifest: See tire website
   Grants: http://portal.ncdenr.org/web/wm/scrap-tire-market-development-grants
   Program Report: http://portal.ncdenr.org/web/wm/sw/swmar
   DENR: http://portal.ncdenr.org/web/guest/
7. **SC Solid Waste:** http://www.scdhec.gov/environment/lwm/html/solidwaste.htm
   Reporting: http://www.scdhec.gov/environment/lwm/forms/wtire_rep.pdf
   Manifest: None. See Hauler Registration at
   http://www.scdhec.gov/administration/library/D-2711.pdf
   Grants: http://www.scdhec.gov/environment/lwm/recycle/grants.htm
   Program Report:
   http://www.scdhec.gov/environment/lwm/recycle/annual_report.htm#buy_the_numbers
   DHEC Environment: http://www.scdhec.gov/environment.htm
8. **TN tire:** http://www.state.tn.us/environment/swm/tires/
   Reporting: County Reporting. See waste tire web site above.

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Manifest: A paper manifest from new tire dealer to county tire collection site. Then an electronically generated report is printed to transfer information from county tire collection site to the state grant program.
Grants: http://tennessee.gov/environment/swm/grants/
Program Report: http://www.state.tn.us/environment/swm/tires/taskforce/
EPD: http://www.tn.gov/environment/

E. Region V
1. IL tire: http://www.epa.state.il.us/land/tires/index.html
   Reporting: http://www.epa.state.il.us/land/tires/annual-tire-summary-notice.pdf
   Manifest: None
   Grants: None
   Program Report: http://www.epa.state.il.us/land/tires/biennial-report.pdf
   IEPA: http://www.epa.state.il.us/
2. IN Tire Permit: http://www.in.gov/idem/5893.htm
   Reporting: http://www.in.gov/idem/5157.htm#olq_tires
   Manifest: http://www.in.gov/idem/5157.htm#olq_tires
   Grants: None
   Program Report: See tire webpage
   DEM: http://www.in.gov/idem/
3. **MI tire:**
   Tire: http://www.michigan.gov/deq/1,1607,7-135-3312_4122---,00.html
   Reporting: none, but annual registration. See
   http://www.michigan.gov/deq/0,4561,7-135-3312_4122-10165--,00.html
   Manifest: http://www.michigan.gov/documents/deq/DNRE-ERMD-ST-EQP_5128_ST_Transport_Record_331356_7.pdf
   Grants: See tire website
   Program Report: see tire website
   DEQ: http://www.michigan.gov/deq
4. MN SW Tire http://www.pca.state.mn.us/index.php/view-document.html?gid=17128
   Reporting: None (Maintain records three years)
   Manifest: None
   Grants: http://www.pca.state.mn.us/index.php/about-mpca/assistance/financial-assistance/environmental-assistance-grants-and-loans/environmental-assistance-grants-program.html
   Program Report: http://www.pca.state.mn.us/index.php/view-document.html?gid=12793
   PCA: http://www.pca.state.mn.us/
5. **OH tire:** http://www.epa.ohio.gov/dsiwm/pages/tirepro.aspx or at:
   http://epa.state.oh.us/dmwm
   Reporting: http://www.epa.ohio.gov/dsiwm/pages/forms.aspx
   Manifest: http://epa.ohio.gov/dsiwm/pages/tire_docs.aspx
   Grants:
   http://www.ohiodnr.com/Home/Grants/ScrapTireGrant/tabid/21190/Default.aspx
   Program Report: Pls. call program office.
   OEPA: http://epa.ohio.gov/dmwm or http://epa.state.oh.us/dmwm

F. Region VI
1. **AR tire:** http://www.adeq.state.ar.us/solwaste/branch_programs/tire_mgt.htm
   Reporting: See
   http://www.adeq.state.ar.us/solwaste/branch_programs/app_packets.htm
   Manifest: See
   http://www.adeq.state.ar.us/solwaste/branch_programs/app_packets.htm

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Grants: See "Waste Tire Grants" on tire website
Program Report: See "Waste Tire Disposition Report" on tire website
DEQ: http://www.adeq.state.ar.us/Default.htm

2. **LA Tire:** http://www.deq.louisiana.gov/portal/Default.aspx?tabid=2327
Reporting:
See regulations at:
http://www.deq.louisiana.gov/portal/Portals/0/planning/regs/title33/33v07-201201.pdf
Manifest: Obtain from Processor
Grants:
Program Report:
DEQ: http://www.deq.louisiana.gov/portal/HOME.aspx
3. **NM tire:** http://www.nmenv.state.nm.us/swb/tires.htm
Reporting: http://www.nmenv.state.nm.us/swb/AnnualReportingsandForms.htm
Manifest: See tire website
Grants: http://www.nmenv.state.nm.us/swb/GrantandLoanPrograms.htm
Program Report: 2007 Solid Waste Management Plan
http://www.nmenv.state.nm.us/swb/fswmp.htm
ED: http://www.nmenv.state.nm.us/
4. OK tire: http://www.deq.state.ok.us/lpdnew/TireRecyclingPrg.htm
Reporting: See rules at http://www.deq.state.ok.us/rules/515.pdf
Manifest: See tire program website
Grants: See "Forms" on tire website
Program Report: See "2010 Land Protection Report" at
http://www.deq.state.ok.us/mainlinks/reports.htm
DEQ: http://www.deq.state.ok.us/
5. TX tire: http://www.tceq.texas.gov/tires/index.html
and http://www.tceq.state.tx.us/compliance/tires/recycling.html
Reporting:
http://www.tceq.texas.gov/assets/public/compliance/tires/forms/10311.pdf
Manifest: http://www.tceq.texas.gov/assets/public/compliance/tires/forms/10304.pdf
Grants: None. See http://www.tceq.texas.gov/tires/tirefacts.html#funding
Program Report: See Recycling at http://www.tceq.texas.gov/tires/recycling.html
CEQ: http://www.tceq.texas.gov/

G. Region VII
1. IA tire:
http://www.iowadnr.gov/Environment/LandStewardship/WasteManagement/Residential/Tires.aspx
Reporting: See rule at
http://www.iowadnr.gov/portals/idnr/uploads/forms/5428132.pdf?amp;tabid=840
Manifest: None. For annual hauler registration, see
http://www.iowadnr.gov/Environment/LandStewardship/WasteManagement/Residential/Tires/TireHaulerRegistration.aspx
Grants: None
Program Report: None
DNR: http://www.iowadnr.gov/Environment.aspx
2. **KS Tire:** http://www.kdheks.gov/waste/forms_wastetires.html
Reporting: None, but maintain records for three years see Kansas Administrative Regulations, Article 29, 28-29-31a(c). See
http://www.kdheks.gov/waste/regsstatutes/sw_laws.pdf
Manifest: None, but must maintain record of transaction per Kansas Statutes Annoted 65-3424b(c). See http://www.kdheks.gov/waste/regsstatutes/sw_laws.pdf
Grants: http://www.kdheks.gov/waste/about_grants.html

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Program Report: See 2010 State Solid Waste management Plan at
http://www.kdheks.gov/waste/reportspublications/stateplan10.pdf
DHE: http://www.kdheks.gov/

3. MO tire: http://www.dnr.mo.gov/env/swmp/tires/tirelist.htm
   Reporting: Scrap Tire Processing Facility Operations Records Form. See
   http://www.dnr.mo.gov/forms/780-1037-f.pdf
   Manifest: Monthly Summary Tracking Form. See
   http://www.dnr.mo.gov/forms/780-1596-f.pdf
   Grants: See "Playground and Non-Playground Grants" at tire website.
   Program Report: See "Scrap Tire Activity legislative Report" and "Scrap Tire Advisory Group Recommendations" at tire website.
   DNR: http://www.dnr.mo.gov/index.html
4. **NE SW Tire:** http://www.deq.state.ne.us/IWM.nsf/Pages/STMP
   Reporting: Annual. Title 132, Chapter 14, 012 of regulations. See
   http://www.deq.state.ne.us/ "Laws & regulations"
   Manifest: None, but annual waste tire hauler permit required.
   Grants: See "WASTE REDUCTION AND RECYCLING INCENTIVE FUND" on tire website and http://www.deq.state.ne.us/, Focus on Land & Waste, Integrated Waste Management Programs, Scrap Tire Management Grant Program."
   Program Report: None
   DEQ: http://www.deq.state.ne.us/

H. Region VIII

1. **CO tire:** http://www.cdphe.state.co.us/hm/wastetires/ and
   http://www.cdphe.state.co.us/oeis/wtprog/wastetire.html
   Reporting: http://www.cdphe.state.co.us/hm/sw/swforms.htm#tire
   Manifest: http://www.cdphe.state.co.us/hm/forms/sw/wt2manifest.pdf
   Grants: http://www.cdphe.state.co.us/oeis/wtprog/wastetire.html
   Program Report: http://www.cdphe.state.co.us/hm/sw/reports.htm
   DPHE: http://www.cdphe.state.co.us/
2. MT Tire: http://deq.mt.gov/Recycle/Tires/default.mcpx
   Reporting: Annual. Refer to ARM rule 17.50.412. See
   http://deq.mt.gov/SolidWaste/LawsRules.mcpx
   Subchapter 4.
   Manifest: None
   Grants: None
   Program Report: See "How Should Wste Tires Be Manged in Montana?" tire website
   DEQ: http://www.deq.mt.gov/default.mcpx
3. **ND tire:**
   http://www.ndhealth.gov/wm/Publications/Guideline21ScrapTireManagement.pdf
   Reporting: None
   Manifest: None
   Grants: None
   Program Report:
   https://www.ndhealth.gov/WM/Recycling/RecyclingSurveyResults/2009.pdf
   EHS: http://www.ndhealth.gov/EHS/
4. **SD Tire:** http://denr.sd.gov/des/wm/tires/tireinfo.aspx
   Reporting: None
   Manifest: None
   Grants: http://denr.sd.gov/dfta/wwf/swmp/swmp.aspx
   Program Report: See "Water and Waste Funding, Annual Reports/State Water Plans" at http://denr.sd.gov/documents.aspx
   DENR: http://denr.sd.gov/

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5. **UT tire:** http://www.hazardouswaste.utah.gov/Solid_Waste_Section/Waste_Tire_Program.htm
   Reporting: None
   Manifest: None
   Grants: See tire website
   Program Report: See "Utah Tire Recycling Summary" at tire website.
   DEQ: http://www.deq.utah.gov/
6. **WY** SW & Corrective Action: Guidelines, "Scrap Tire Management"
   http://deq.state.wy.us/shwd/downloads/guidelines/swg21.pdf
   Reporting: See "Rules" on SW website
   Manifest: None
   Grants: None
   Program Report: None
   DEQ: http://deq.state.wy.us/

I. Region IX
1. **AZ tire:** http://www.azdeq.gov/environ/waste/solid/tires.html
   Reporting: See tire website, "Related Statutes", "Waste Tires"
   Manifest: See tire website, "Related Statutes", "Waste Tires"
   Grants: See tire website, "Related Statutes", "Waste Tires"
   Program Report: See tire website, "Related Statutes", "Waste Tires"
   DEQ: http://www.azdeq.gov/index.html
2. **CA Tire:** http://www.calrecycle.ca.gov/tires/
   Reporting: See Manifest, Electronic Data Transfer of Manifest.
   Manifest: http://www.calrecycle.ca.gov/Tires/Manifest/default.htm
   Grants: http://www.calrecycle.ca.gov/Tires/Grants/default.htm
   Program Report: http://www.calrecycle.ca.gov/Publications/Tires/2011014.pdf and http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1381
   CalRecycle: http://www.calrecycle.ca.gov/
3. HI S & HW: http://hawaii.gov/health/environmental/waste/sw/index.html
   Reporting: See Sample Tire Acceptance/Removal Documentation Form and Motor Vehicle Tire Recovery Summary at http://hawaii.gov/health/environmental/waste/sw/index.html
   Manifest: None.
   Grants: None
   SW Program Report: http://hawaii.gov/health/environmental/hazard/docs/rpt2010.pdf
   DOH: http://hawaii.gov/health/
4. NV Special Wastes: http://ndep.nv.gov/bwm/special.htm
   Reporting: http://ndep.nv.gov/bwm/Docs/TireTransportation_Guidence.pdf
   Manifest: See above site.
   Grants: See "Solid Waste and Recycling Grant Program" at http://ndep.nv.gov/bwm/documen.htm
   Program Report: None.
   NDEP: http://ndep.nv.gov/index.htm

J. Region X
1. AK SW: http://www.dec.state.ak.us/eh/sw/index.htm
   Reporting: None
   Manifest: None
   Grants: None
   Program Report: None
   DEC http://www.dec.state.ak.us/

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2. ID Tire: http://www.deq.idaho.gov/waste-mgmt-remediation/solid-waste/waste-tires.aspx
   Reporting: None
   Manifest: None
   Grants: None
   Program Report: None
   DEQ: http://www.deq.idaho.gov/
3. OR Tire: http://www.deq.state.or.us/lq/sw/tires/index.htm
   Reporting: See Report Forms on above site
   Manifest: None. See Waste Tire Carriers, Frequently Asked Questions on above site
   Grants: http://www.deq.state.or.us/lq/sw/grants/
   Program Report: http://www.deq.state.or.us/lq/sw/recovery/materialrecovery.htm
   DEQ: http://www.oregon.gov/DEQ/
4. **WA Tire:** http://www.ecy.wa.gov/programs/swfa/tires/
   Reporting: http://www.ecy.wa.gov/pubs/ecy040168.pdf
   Manifest: No
   Program Report: http://www.ecy.wa.gov/programs/swfa/tires/pubs.html
   Grants: See tire website
   Program Report: http://www.ecy.wa.gov/programs/swfa/tires/pubs.html
   DOE: http://www.ecy.wa.gov/ecyhome.html

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http://www.epa.gov/epawaste/conserve/materials/tires/grants.htm

The majority of funding for scrap tire management, recycling programs, and market development is at the state level. However, some Federal research funding is available for small business doing innovative research. EPA does not provide funding for businesses using established technologies. Businesses who receive Federal Funds to purchase products made from rubber are required to purchase them made from recycled rubber according to EPA's Comprehensive Procurement Guidelines. See http://www.epa.gov/epawaste/conserve/tools/cpg/products/garden.htm for one example and see: http://www.epa.gov/epawaste/conserve/tools/cpg/products/index.htm for all designated CPG products and http://www.epa.gov/epawaste/conserve/tools/cpg/faqs.htm for further questions about the CPG.

EPA's Small Business Innovation Research (SBIR) Program is administered by the Agency's National Center for Environmental Research and Quality Assurance (NCERQA) in the Office of Research and Development. The Agency's SBIR Program solicits and funds research proposals that address EPA priority needs including solid waste management techniques. The goal is to promote technology innovation and commercialization. The Program is intended to spawn commercial ventures that improve our environment and quality of life, create jobs, increase productivity and economic growth, and enhance the international competitiveness of the US technology industry. Generally, businesses with fewer than 500 employees are eligible to receive an SBIR award.

State agencies provide the majority of funding for scrap tire management and clean-up. Some states have recycling market development programs that offer financial assistance. Contact your state agency for specific information on grant/funding opportunities.

Examples of scrap tire projects funded at the state level:

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- CalRecycle's (California) tire grant programs are designed to encourage activities that promote reducing the number of waste tires going to landfills for disposal and eliminating the stockpiling of waste tires. Activities include tire pile cleanup and enforcement, market development, and demonstration projects. Prior programs have focused on research, business assistance, market development, product procurement, amnesty events, tire pile cleanup, and enforcement. Eligible applicants have included individuals, businesses, local governments, universities, school districts, park districts, and qualified California Indian tribes. For more information, please click here: http://www.calrecycle.ca.gov/tires/Grants/

- New York's Empire State Development has the Scrap Tire Market Development Program available through its Environmental Investment Program (EIP). For more information, please see: http://esd.ny.gov/businessprograms/environmentalassistance.html and http://esd.ny.gov/businessprograms/SecondaryMarketInfo.html

- New Mexico: Nunicipalities, counties, Indian nations, pueblos, tribes, land grant communities or cooperative associations are eligible for grants from the tire grant fund. Grants are awarded annually for abatement of illegal dumpsites, development costs or operating costs to establish a recycling facility, purchase equipment, perform marketing, purchase products produced by a recycling facility, provide educational outreach and develop recycling infrastructure. For FY 2012, $500,000 was awarded in tire grants to ten communities. For more information, please click on http://www.nmenv.state.nm.us/swb/tires.htm and http://www.nmenv.state.nm.us/swb/GrantandLoanPrograms.htm

- Kentucky awarded 14 crumb rubber grants in 2010 totaling $282,814 for crumb rubber mulch on playgrounds and crumb rubber on athletic or multi-use fields. The state also disbursed direct grants to 117 counties, at $3,000 each, in Fiscal year 2010 (July 1, 2010 to June 30, 2011) to help defray the cost for disposal and recycling of abandoned scrap tires. For more information, click here: http://waste.ky.gov/RLA/grants/Pages/default.aspx

- Michigan has market development grants to issue grants to use available funding to promote increased markets to reduce the public health and environmental concerns associated with scrap tires, such as modified asphalt, molded or extruded rubber products, or aggregate replacement materials; or the project must be for the research and development of methods to increase market share. Five grants totaling $783,761 were awarded to Saginaw County in FY 2011 to provide for the increased use of scrap tires in road projects. For more information, please click on: http://www.michigan.gov/documents/deq/Grant_Program_Recipients_266799_7.pdf and http://www.michigan.gov/deq/0,1607,7-135-3312_4122---,00.html

- Washington: Starting in 2010, the State of Washington Department of Ecology provided grants to local governments and public entities for tire related efforts, including enforcement, tire amnesty events, tire pile prevention and cleanups; education and outreach; and reducing illegal tire dumping. The tire grants are explained on the agency website at: http://www.ecy.wa.gov/programs/swfa/tires/cleanup.html) and listed in the "Tire Project" Table link on that page.

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- South Carolina DEHC works with the Asphalt Research Technical Service (ARTS) at Clemson University to administer grants. For more information, click here: http://www.clemson.edu/ces/arts/application.html

- The Arkansas Department of Environmental Quality Waste Tire Program distributes approximately $4,750,000 annually in grants to the regional solid waste management district boards for management of scrap tires generated within the state. The grants are funded by fees collected on retail sales of auto and truck tires. Funding supports infra-structure and other scrap tire program activities. For more information, please click here: http://www.adeq.state.ar.us/solwaste/branch_programs/tire_mgt.htm#Waste_Tire_Grant_General_Information

- For links to grant information for other states, please refer to “Where you live”.

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http://www.epa.gov/epawaste/conserve/materials/tires/science.htm

Background | Innovative Uses for Scrap Tires | Other Innovative Uses in the News

Background

The Army Corps of Engineers used tires to protect marshland on Gaillard Island, Alabama from wave action, enabling plant root systems to establish.

In recent years, research on uses for scrap tires and advances in technology have created many new markets and innovative applications. New uses for ground rubber and advances in civil engineering keep millions of tires out of landfills and stockpiles every year.

EPA performs research and development to identify, understand, and solve current and future environmental problems. EPA's Office of Research and Development has conducted research projects on scrap tires through EPA's National Center for Environmental Research. Research topics have included rubberized asphalt, bridge erosion protection, air emissions from scrap tire combustion, and pyrolysis.

One EPA funded project investigated the use of scrap tires to form a protective system for mitigating local scour around bridge pier s. Local scour is the erosion of the riverbed around bridge piers. Bridge failure caused by this phenomenon has long been an important issue with respect to both public safety and maintenance costs. Nearly half a million bridges nationwide are potentially affected by local scour. A honeycomb structure of scrap tires can mitigate local scour by modifying the water flow in the vicinity of a bridge pier and adjacent riverbed (more information on this project).

The U.S. Department of Energy (DOE) also conducts research on innovative scrap tire uses. One project, sponsored by DOE's Office of Energy Efficiency and Renewable Energy, investigated the development of a method for treating rubber from scrap tires so that it can be used in various applications such as carpet underlay, automotive seals and gaskets, caulks, sealants, and adhesives. The treated rubber requires much less energy to produce than the polymers it replaces. More information on scrap tire research at DOE.

Innovative Uses for Scrap Tires

Scrap Tire Promotional Video
Tire-Derived Aggregate in Civil Engineering Applications

Highway Sound Barriers

Many states are turning to absorptive sound barriers—structures that soak up sound—to reduce highway noise. The "Whisper Wall" used in Northern Virginia, starts as a mixture of concrete aggregate, cement, water, and small pieces of shredded rubber from scrap tires. The wall deflects sound waves among its nooks and crannies until they lose energy.

Commented [MRS18]: What about electric arc furnaces?

Athletic and Recreational Applications

Several brands of resilient playground rubber surfacing material are being made from recycled tires and sold at major retailers across the US. The material can absorb much of the impact from falls providing added safety to children. This material can also be used as a mulch replacement in medians or decorative areas. Athletic and recreational applications are a fast growing market for ground rubber. An estimated 80 million pounds of scrap tire rubber were used in 2001 for athletic/field turf applications (50 million pounds)—above or below the ground—and as loose cover (30 million pounds).

Railroad Ties

Highly durable, rubber-encased railroad ties are being produced using scrap tires. These railroad ties have a steel-beam core filled with concrete that is then encased in 80 pounds of ground-up scrap tires and discarded plastic bottles, held together with a special binder or glue. These railroad ties are over 200% stronger than creosote-soaked wooden ties, enabling railroads to use fewer ties per mile. Moreover, rubber-encased railroad ties could last 60 to 90 years versus 5 to 30 years for wood.

Pyrolysis

Pyrolysis is a method to break down tires into potentially usable end products. Called by a variety of names, such as thermal distillation and destructive distillation, pyrolysis is the heating of organic compounds in a low oxygen environment.

Pyrolysis of waste tires generates combustible gases, oil, and char products. The quantity and quality of each product depends on variables including temperature, pressure, and residence time. Outputs for a typical pryolysis process are:

- Oil: Usually varies in quality from saleable fuel oil that may need processing to lower-value oil blend stock.
- Char: Contains a mixture of carbon black, titanium dioxide, zinc, steel and other trace inorganic compounds present in tires.
- Gas: May be used to fuel the pyrolysis process or be combusted in a flare.

Although many attempts have been made over the past several decades, EPA is not aware of any commercial pyrolysis systems operating continuously in the US. According to the U.S. Rubber Manufacturer's Association's 2009 Edition, Scrap Tire Markets in the United States EXIT Disclaimer, tire

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pyrolysis did not play a role in the management of scrap tires in the United States as of late 2009. One reason for this is that the value of the pyrolysis-derived oil, char, and gas has thus far been lower than the overall cost of the pyrolysis process that produced them. The technology continues to be explored for commercial feasibility, and there are a limited number of pilot operations that have been recently built.

When investigating the pyrolysis process, some of the practical considerations include:

- Challenges of operating in an oxygen-limited, high temperature environment with complex equipment and an abrasive feedstock (scrap tires);
- Environmental considerations such as the need for air emission control systems and disposal of products or byproducts that may be unmarketable. In addition, zinc and sulfur, both found in tires, are not destroyed or decomposed thermally and may remain in one or more of the pyrolysis products;
- It is difficult to optimize quality and yields of the pyrolysis-derived gas, oil, and char since conditions that favor one often have a negative impact on another. Refining end products may add costs if it is necessary to meet customer needs and may require additional pollution controls;
- Markets of sufficient size and price that support the pyrolysis operation must be developed for pyrolysis-derived oil, char and gas. The quality and thus value of these end products may be different from the commercially available materials against which they are competing;
- Products may have regulatory requirements that need to be met in order to be sold (i.e., Toxic Substance Control Act (TSCA);
- The high cost of operating:
- The need to ensure availability of a steady and adequate supply of tires within an affordable haul distance.

Additional Information:

The Manufacture of Carbon Black From Oils Derived From Scrap Tires

4.24 Pyrolysis, Ex Situ Soil Remediation Technology, Remediation Technologies Screening Matrix and Reference Guide, Version 4.0 (FRTR)

2007 Edition, Scrap Tire Markets in the United States (U.S. Rubber Manufacturers Association, May 2009)

Other Innovative Uses in the News

- Scrap Tire News: news and information about the scrap tire industry EXIT Disclaimer
- Road Management Journal, "Tires: A New Source for Culvert Pipe", August 1997 EXIT Disclaimer
- NewsFactor Network, "Scientists Tweak Old Recycling Technique To Attack Tire Problem", March 2002 EXIT Disclaimer
- Biocycle, "Funding for Innovative Uses for Scrap Tires", March 1999 EXIT Disclaimer
- Other Related Links

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http://www.epa.gov/epawaste/conserve/materials/tires/publications.htm

EPA Publications | Other Publications | Additional EPA Publications

You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

New Reports

Connecticut Risk Assessment: July 2010 Connecticut Department of Energy & Environmental Protection, Risk Assessment of Artificial Turf Fields. The report is a compilation of four separate state agency reports (UCHC, CAES, DPH, DEP) completed a two year comprehensive evaluation of health and environmental impacts associated with artificial turf fields containing crumb rubber infill. www.ct.gov/dep/artificialturf

ORD Study: 12/10/2009 U.S. EPA Office of Research and Development NERL, Limited EPA Study Finds Low Level of Concern in Samples of Recycled Tires from Ballfield and Playground Surfaces. Study Http://www.epa.gov/nerl/features/tire_crumbs.html

Scrap Tire: Handbook on Recycling Applications and Management for the U.S. and Mexico. August 2011 At http://www.epa.gov/nscep/. EPA530-R-10-010 This report provides a resource for federal, state, and local governments along with private industry in developing markets for the valuable resources contained in scrap tires. Specific markets and applications addressed include energy use, tire-derived aggregate, and ground rubber. Technical, environmental, economic, and reference information is provided for major scrap tire recycling applications to allow industry and government to assess, prioritize, target, and develop markets as efficiently and rapidly as possible. Available in English and Spanish versions.

Publications

Border 2012: US–Mexico Border Scrap Tire Inventory Summary Report (PDF) (22 pp, 1.9MB) May 2007

This report and accompanying map provide an inventory of the major known scrap tire piles found in the entire US-Mexico border area. This information is helping the United States and Mexico determine the most effective and efficient ways to clean up and prevent scrap tire piles in the border area and identify possible markets for scrap tires.

Air Emissions From Scrap Tire Combustion (PDF) (117 pp, 650K) October 1997 This study focuses on (1) examining air emissions related to open tire fires and

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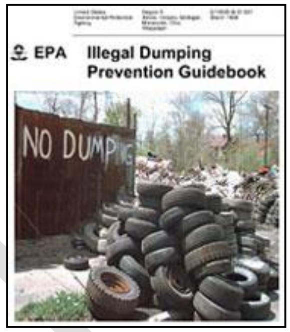
their potential health impacts, and (2) reporting on emissions data from well designed combustors that have used tires as a fuel.

Analysis Of Ambient Monitoring Data In The Vicinity Of Open Tire Fires (PDF) (97 pp, 3.1MB) July 1993 This study identifies the major air contaminants that result from uncontrolled tire fires and documents the results of air monitoring data from 22 actual tire fire emergencies.



Buy-Recycled Series: Vehicular Products (PDF) (8 pp, 455K) October 2007 EPA fact sheet on buying recycled vehicular products-including retreaded tires-through the Comprehensive Procurement Guidelines (CPG) program.

Illegal Dumping Prevention Guidebook (PDF) (33 pp, 1.1MB) March 1998 This document presents the nature of the illegal dumping problem and summarize lessons learned from collaborative prevention projects across the United States.

Markets for Scrap Tires (PDF) (119 pp, 926K) October 1991 [Note: The report contains dated material since this report is several years old] This report discusses the problems associated with scrap tires and identifies existing and potential source reduction and utilization methods that may be effective in solving the tire problem. Barriers to increased utilization and options for removing the barriers are identified and evaluated.

Profile of the Rubber and Plastics Industry September 1995 This document contains industry information (economic and geographic); a description of industrial processes, pollution outputs, and pollution prevention opportunities; and compliance history.

Scrap Tires in the Great Lakes Region (PDF) (3 pp, 4.4MB) May 2004 This brochure describes the scrap tire management issue in the Great Lakes Region, addressing (1) the issue of clean-up and management of existing scrap tire piles, and (2) utilization of scrap tire material for energy recovery, civil engineering, and a variety of products ranging from playground cover to guard rails.

State Scrap Tire Programs - A Quick Reference Guide: 1999 Update (PDF) (53 pp, 262K) August 1999 [Note: The report contains dated material (state contacts) since this report is several years old] This guide summarizes each state's scrap tire management legislation and programs in a matrix for each state program. It provides state regulators, as well as members of industry, with a quick reference on state scrap tire programs across the country.

Writing Business Plans for Recycling Enterprises: Plastics, Glass, or Rubber (PDF) (208 pp, 2.8MB) US EPA and the Association of Small Business Development Centers, January 1998 This guide describes the elements of formal, written business plans specific to recycling post-consumer plastics, glass, or rubber. The guide combines information on how to write a business plan, actual business plans that have been used to launch successful enterprises, and a resource directory.

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Region 5 Scrap Tire Cleanup Guidebook January 2006 To help state and local governments reduce the economic burdens and environmental risks associated with scrap tire piles on their landscapes, US EPA Region 5 and Illinois EPA have collaborated to create the Scrap Tire Cleanup Guidebook. The guidebook brings together the experience of dozens of professionals in one resource designed to provide state and local officials with the information needed to effectively clean up scrap tire piles. The guidebook discusses starting a cleanup program, working with contractors to clean up sites, and implementing prevention programs that will reduce scrap tire dumping.

Other References

2008 Air Emission Data Summary for Portland Cement Pyroprocessing Operations Firing Tire-Derived Fuels (PDF) (32 pp, 195K) Portland Cement Association, 2008. This report highlights data concerning the impact of tire-derived fuel (TDF) firing on air emissions from pyroprocessing operations. The report also features statistical comparison in emission data sets between TDF versus non-TDF firing kilns for a variety of air contaminants.

2008 Tire Derived Fuel Sustainable Manufacturing Fact Sheet (PDF) (4 pp, 914K)
Portland Cement Association, 2008. This fact sheet highlights the utilization of scrap tires as an alternative fuel source in the manufacture of cement. It also features recent trends in tire derived fuel consumption across US cement plants and includes an overview of the cement making process.

2007 Edition, Scrap Tire Markets in the United States EXIT Disclaimer
Rubber Manufacturers Association, May 2009 This report is the most comprehensive compilation of US scrap tire management status. This report gives the status of the various scrap tire markets, discusses trends in scrap tire management, and gives the number of remaining scrap tire piles. The study also details some of the challenges facing future scrap tire clean up and market development.

Environmental Fact Sheet: Scrap Tire Management in New Hampshire (PDF) (3 pp, 48K) EXIT Disclaimer New Hampshire Department of Environmental Services, Waste Management Division, Solid Waste Management Bureau, 2000 This fact sheet provides a general overview of scrap tire management in the state of New Hampshire.

Illinois EPA Used Tire Program Report EXIT Disclaimer
Illinois EPA, Bureau of Land, Division of Land Pollution Control, January 1999
This report provides a history of Illinois' Used Tire Program, details accomplishments, and outlines future priorities.

North Carolina Scrap Tire Management Report (PDF) (10 pp, 37K) EXIT Disclaimer
North Carolina Department of Environment and Natural Resources, October 2000
This report provides a summary of scrap tire management in North Carolina including regulations, fees, and future management goals.

Oregon Tire Recycling Report EXIT Disclaimer
Oregon State Legislature, Task Force on Tire Recycling, October 2002

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This report includes information on Oregon's Tire Recycling Program. The report also details sources and uses for scrap tires in the state.

Prevention and Management of Scrap Tire Fires (PDF) (37 pp, 90K) EXIT Disclaimer
Scrap Tire Management Council, March 2000 In June of 1992, as part of an effort supported by the International Association of Fire Chiefs and the Scrap Tire Management Council, 17 individuals representing the fire service, government and industry met in Washington, D.C. to exchange information and experiences on managing tire fires. The recommendations of this group are contained in this document, and can be helpful in the prevention, planning and management of scrap tire fires. This document was updated in March 2000 to reflect changes to National Fire Protections Association guidelines.

Resource Recycling Magazine EXIT Disclaimer
This monthly periodical provides comprehensive information on post-consumer waste recovery efforts and recycling in the US including scrap tires markets. Both hard copy and online subscriptions are available.

Scrap Tire and Rubber Users Directory EXIT Disclaimer
Recycling Research Institute, 2002 Available for ordering through the Scrap Tire News website, this comprehensive directory outlines the activities and services provided by companies servicing the tire and rubber recycling industry. Published and updated yearly, it features an exclusive Market Price Survey which provides current statistical market data and current market prices for materials such as crumb rubber, tire-derived fuel, and buffings.

Scrap Tires: Disposal and Reuse EXIT Disclaimer
Society of Automotive Engineers and Robert H. Snyder, 1998 This comprehensive book describes the overall problem of waste tires, collection and processing issues, and the many innovative uses for scrap tires. The book also summarizes the technical and regulatory issues associated with scrap tire generation, disposal, and recovery.

Tire Recycling Is Fun EXIT Disclaimer
Published by Paul Farber, 1998 Available for ordering through the Scrap Tire News website, this book contains over 50 useful projects for scrap tires and step-by-step guides to making items such as a tire swing, tire garden, and a Sabre saw blade.

Washington State Scrap Tire Report EXIT Disclaimer
Washington Department of Ecology, Solid Waste and Financial Assistance Program, December 2002 This report is provides information on scrap tire management in Washington State and the surrounding region. Many types of scrap tire management programs are highlighted and provide information, examples, and lessons learned.

Additional EPA Materials

The following documents are offered online through EPA's National Service Center for Environmental Publications (NSCEP). To use the system, go to the NSCEP website and search by title of the document, publication number, or general subject (e.g., scrap tires, tire fires). Users may view

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documents as page images (in .TIF format). Each document can be viewed one page at a time, and each page image can be downloaded or printed.

- ***Environmental Fact Sheet: EPA Guideline for Purchasing Retread Tires.*** EPA530-SW-91-045. 1991.
- ***Environmental Fact Sheet: Purchasing and Maintaining Retread Passenger Tires.*** EPA530-F-95-019. 1995.
- ***Guideline For Federal Procurement of Retread Tires; Final Rule.*** EPAOSW-FR-90-005. 1988.
- ***Scrap Tire Handbook.*** EPA905-K-001. 1993.
- ***Summary of Markets for Scrap Tires.*** EPA530-SW-90-074B. 1991.

Any EPA publication may also be ordered from EPA's National Service Center for Environmental Publications (NSCEP). Publications may be ordered online, or by calling 800-490-9198.

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EPA Scrap Tire Workgroup

http://www.epa.gov/epawaste/conserve/materials/tires/workgroup.htm

Goals Committee | Civil Engineering Committee | Tire Derived Fuels Committee | Ground Rubber Committee |

Background

The Scrap Tire Workgroup was created in 2003 by EPA to gather together public and private individuals who share a common goal: to effectively manage over 300 million scrap tires generated each year in the US and to eradicate the 500 million tires in stockpiles.

Since its inception, the Workgroup has supported the successful achievement of critical tasks in the field of scrap tire management. Its efforts have delivered environmental, social and economic benefits to individual states and the country as a whole.

(See Contribution to EPA's 2011-2015 Strategic Plan)

The scrap tire industry in the US is worth over $500 million dollars annually and employs over 10,000 people.

The Scrap Tire Workgroup is committed to the sustainable use of scrap tires: products made from crumb rubber, such as automotive parts, rubber products and flexible materials; rubberized asphalt; civil engineering uses; and tire derived fuel.

Workgroup Contact Information

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EPA's leadership in establishing and coordinating the workgroup has been critical to the success of it of its efforts. In its final rule on Non-Hazardous Secondary Materials (NHSM), EPA recognized the vital role scrap tire management plays in resource conservation. EPA's awareness and keen

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understanding of the scrap tire marketplace is due, in part, to its involvement in the Scrap Tire Workgroup. In the NHSM rule, EPA determined that scrap tires that are collected as part of established scrap tire collection systems are not discarded, and therefore are not considered to be solid waste when utilized as tire derived fuel, so long as they meet the established legitimacy criteria. The Scrap tire collection system touted in the final rule are managed by state and industry members of the Workgroup, among others. The final rule treatment of scrap tires demonstrates EPA's support of legitimate scrap tire markets.

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Workgroup Accomplishments

Worked with states to accomplish diversion of 89% of newly generated scrap tires to beneficial uses or recycling

Cooperation between states and Workgroup contributors achieved significant reduction of tires in stockpiles - over 87% between 1990 and 2007

2005 Tire-derived Fuel (TDF) Factsheet

Produced and distributed educational DVD on Tire-derived Aggregate (TDA) in Civil Engineering Applications

Weight based biennial market assessment via the Rubber Manufacturers Association (RMA)

National list of Tire-derived Aggregate (TDA) projects

Development of documents in response to EPA proposed rules

Provided forum for discussion of proposed rules and other topics

Emissions database on hundreds of TDF users

EPA Region 8 Scrap Tire Reuse Webinar -- 2/23/2010

Annual meetings since 2005

Updated EPA Scrap Tire Website and developed new web pages

Organized various meetings and functions

Provided support and coordinated events

Assisted RMA in collecting State Surveys data on biennial scrap tire use

Worked with EPA on interpretation of the NHSM final rule 76 Fed. Reg. 15456 (March 21, 2011)

Contributions to EPA's 2011-2015 Strategic Plan

The activities of the Workgroup contribute to each of EPA's 5 Priorities for 2011-2015:

Taking Action on Climate Change and Improving Air Quality

- Beneficial uses better than landfilling
- Tire-derived Fuel (TDF) can reduce air emissions (2005 EPA Fact Sheet)
- Eliminating tire piles reduces fire potential and associated air pollution

Protecting America's Water

- Tire-derived products are acceptable to human health and the environment
- Eliminating tire piles reduces fire potential and associated water pollution

Cleaning up Communities and Advancing Sustainable Development

- Hundreds of millions dollars have been invested in cleaning up tire dumps, most in Environmental Justice-challenged locations
- Scrap tires are converted to valuable commodities, reducing demand for natural resources
- Beneficial use reduces the need for raw materials and associated pollution

Enforcing Environmental Laws

- Scrap tire laws and regulations effectively manage scrap tire generation, hauling, collection, storage, processing and end use
- Partnerships with EPA enhance continued success

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The Scrap Tire Workgroup contributes to the overall goals of Sustainable Materials Management, a multi-faceted initiative implemented by USEPA with the goal of sustainable tire uses. The Key message is simple. We need to:

- Fulfill our needs while using less, reducing toxics and recovering more
- Manage materials much more carefully
- Promote efforts to manage products on a life-cycle basis
- Build our capacity to manage materials
- Accelerate public dialogue on how to manage materials
- Create a green, resilient and completive economy

Reference Sustainable Materials Management: The Road Ahead, June 2009 EPA530-R09-009

The Scrap Tire Workgroup consists of approximately 85 representatives from state environmental agencies, industry, EPA, non-profits and academia with expertise in scrap tire management, market development, and application technologies. (See the Current Workgroup Contributors)

***Announcements and Upcoming* Events**

- **Planning Annual Scrap Tire Work Group Meeting in Oct 2012 Montgomery AL**
- **Arkansas Recycling Coalition 22nd Conference & Trade Show, Sept 12-14, 2012, Robinson Center and Double Tree Hotel, Little Rock, AR**
- **5th Annual Scrap to Profit Symposium in Oct 9th – 11th 2012 Montgomery AL**

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Contributors to the Workgroup

States - All Links Exit EPA EXIT Disclaimer

- Arizona Dept. of Environmental Quality
- Arkansas Dept. of Environmental Quality
- California Integrated Waste Management Board CARecycle
- Colorado Dept. Public Health & Environment
- Florida Dept. of Environmental Protection
- Georgia Dept. of Natural Resources
- Illinois Environmental Protection Agency
- Indiana IDEM-Office of Land Quality
- Kentucky Dept. of Environmental Protection
- Louisiana DEQ
- Michigan DNRE
- Minnesota Dept. of Transportation
- Mississippi Dept. of Environmental Quality
- Missouri Dept. of Natural Resources
- New Mexico Environment Dept.
- New York Empire State Development
- North Dakota Dept. of Health SWP DWM
- Ohio EPA
- Oklahoma Dept. of Environmental Quality
- Pennsylvania Dept. of Environmental Protection
- South Carolina Dept. of Health and Environmental Control
- South Dakota Dept. of Environment and Natural Resources
- Tennessee Dept. of Environ. Conservation
- Texas Commission on Environmental Quality
- Utah Division of Solid and Hazardous Waste
- Virginia Dept. of Environmental Quality
- Washington Dept. of Ecology
- Wisconsin Department of Natural Resources
- Wyoming Dept. of Environmental Quality

Academia - All Links Exit EPA EXIT Disclaimer

- Clemson University
- University at Buffalo
- University of Illinois
- University of Maine

Trades/Industry - All Links Exit EPA EXIT Disclaimer

- Arkansas Recycling Coalition
- Asphalt Rubber Tech. Services
- Babst, Calland, Clements & Zomnir, P.C.
- Cement Kiln Recycling Coalition
- Central Vermont Solid Waste Mgmt. District
- Colt Industries
- Columbus-McKinnon Corporation
- Cooper Tire & Rubber Co.
- DK Enterprises
- First State Tire Recycling
- Institute of Scrap Recycling Industries
- JaiTire Portland Cement Industries, Inc.
- JJA Sports
- Lassiter Consulting
- Liberty Tire Services Inc.
- Ontario Tire Stewardship
- Phoenix Industries LLC
- PolyVulc
- Portland Cement Association
- Rhode Island Resource Recovery Association
- Recycling Research Institute / Scrap Tire News
- Rubber Applications & Technologies
- Rubber Pavement Association
- Rubber Manufacturers Association
- Systech Environmental Corporation
- Synthetic Turf Counsel
- TAG Resource Recovery
- Tex-American Recycling and Tire Disposal
- Tire Industry Association
- Tri-Rinse, Inc

Federal Agencies EXIT Disclaimer

- Federal Highway Administration
- EPA

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EPA Scrap4 Tire Website Revisions (DRAFT)
09-19-2011

Commented [MRS19]: Note to Website Editor Insert web links to the Contributors to the Workgroup table.

I. Missing/Non-working Links at ST Workgroup Home:
A. State:
1. Arizona DEQ: http://www.azdeq.gov/
2. Colorado DPHE: http://www.cdphe.state.co.us/
3. Indiana DEM: http://www.in.gov/idem/
4. Kentucky DEP: http://dep.ky.gov/Pages/default.aspx
5. Louisiana DEQ: http://www.deq.louisiana.gov/portal/
6. Michigan DNR: http://michigan.gov/dnr
7. New Mexico Environment: http://www.nmenv.state.nm.us/
8. New York Empire State Development: http://www.empire.state.ny.us/
9. North Carolina DENR: http://portal.ncdenr.org/web/guest
10. North Dakota Dept. of Health SWP DWM: https://www.ndhealth.gov/wm/SolidWasteProgram/
11. Ohio EPA: http://www.epa.state.oh.us/
12. Pennsylvania DEP: http://www.depweb.state.pa.us/portal/server.pt/community/dep_home/5968
13. Tennessee DEC: http://www.state.tn.us/environment/
14. Washington DOE: http://www.ecy.wa.gov/
15. Wisconsin DNR: http://www.dnr.state.wi.us/
16. Wyoming DEQ: http://deq.state.wy.us/

B. Academia:
1. University of Illinois: http://illinois.edu/
2. Asphalt Rubber Technology Services: http://www.clemson.edu/ces/arts/

C. Trades/Industry:
1. Arkansas Recycling Coalition: http://www.recycleark.org/
2. Babst, Calland, Clements & Zomnir, P.C.: http://www.babstcalland.com/
3. Central Vermont Solid Waste Mgmt. District: http://www.cvswmd.org/
4. Colt Industries: http://coltindustries.com/
5. Cooper Tire & Rubber Company: http://coopertire.com/
6. First State Tire Recycling: http://www.firststatetire.com/home.html
7. JaiTire Portland Cement Industries, Inc.: (Can't find)
8. JJA Sports: http://jjasports.com/
9. Lassiter Consulting: e-mail: Lassiterconsulting@gmail.com
10. Liberty Tire: http://libertytire.com/Home.aspx
11. Ontario Tire Stewardship: https://www.ontariots.ca/sp/index.html
12. Rubber Applications & Technologies (American Rubber Technologies, Inc.?): http://www.americanrubber.com/ ?
13. Systech Environmental Corporation: http://www.go2systech.com/
14. Synthetic Turf **Council**: http://syntheticturfcouncil.org/
15. TAG Resource Recovery: e-mail: tagray@flash.net

D. Federal Agencies:
1. Federal Highway Administration: http://www.fhwa.dot.gov/
2. EPA: http://www.epa.gov/

The activities of the Scrap Tire Workgroup have and will continue to be instrumental in delivering and expanding the benefits of scrap tire recycling by providing a multi-stakeholder forum where representatives from industry, government, non-profits can meet, share knowledge and best practices, and develop collaborative projects that further environmental and economic objectives.

Going forward, the Scrap Tire Workgroup will be enhancing its focus on initiatives that drive economic activity and green job creation in the US by growing environmentally and

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economically sustainable markets for the recycled rubber products manufactured by U.S. companies involved in the scrap tire and rubber industry.

The Scrap Tire Workgroup is comprised of five committees. They are the:

1. Goals Committee,
2. Ground Rubber Committee,
3. Civil Engineering Committee,
4. Asphalt Rubber Committee, and
5. Tire Derived Fuel Committee.

Scrap Tire Video

Tire-Derived Aggregate in Civil Engineering Applications

http://www.youtube.com/view_play_list?p=9BEoo25147873678

The Scrap Tire Workgroups maintains electronic contact through the internet, e-mail, and the Yahoo listserv with bimonthly conference calls and an annual meeting. It serves as a venue where national stakeholders in the scrap tire recycling industry can collaborate to achieve common objectives.

Goals Committee

http://www.epa.gov/epawaste/conserve/materials/tires/workgroup/goals.htm

Purpose

To develop and coordinate a mission or plan of action for the Workgroup.

This committee has established with the cooperation of all the workgroup members measureable goals for scrap tires management in the United States.

Goals established include traditional numerical goals for scrap tire recovery and stockpile reductions, as well as broader market support goals involving each of the four market sectors committees and the scrap tire industry.

Committee Members

Chairwoman:
Elizabeth Hoover, AR DEQ

Allan Lassiter, Lassiter Consulting
Michael Blumenthal, RMA
Dan Fester, MO DNR
Terry Gray, TAG Resources Recovery
Cynthia Hackathorn, TX DEQ
Denise Kennedy, DK Enterprises
Todd Marvel, IL EPA
Mary Sikora, TIA, Recycling Research Institute, Scrap Tire News
Kara Steward, Washington Dept. of Ecology
Mark Schuknecht, US EPA

Goals and Targets

The goals adopted by the Scrap Tire Workgroup include:

Traditional Numerical Goals

- By 2012, increase by 5% the amount of newly generated scrap tire tonnages diverted to beneficial re-use, including ground/crumb rubber recycling , tire-derived fuel, and tire-derived aggregate for civil engineering applications, compared to the 2009 amount, based on RMA data.
- By 2012, reduce the number of stockpiled tires by 65% using the 2003 amount as the base year.

Market Support Goals

- Support all market sectors and sub-sectors, primarily through evaluation efforts, regulatory changes, information dissemination and overall education.
- Post information, resource documents and links for each scrap tire market sector and sub-sector on the website and other pertinent websites. Encourage EPA to adopt a Fact Sheet on each market sector and sub-sector.
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- Offer alternate solutions when possible to discourage tire monofilling, landfilling, and land reclamation projects. Encourage careful review of proposed technologies with a history of unsuccessful operations.
- Identify champions and success stories in the government and industry sectors.
- Encourage States to adopt use of American Society of Testing Materials (ASTM) standards for all tire-derived applications.
- Define the use of the passenger tire equivalent (PTE) for measurement of tire generation and market data.

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Workgroup Operational Goals

- EPA will continue to facilitate the Scrap Tire Workgroup through organizing information sharing, networking, meetings, conference calls, e-mail exchanges, and the Yahoo Listserv.
- Use the Scrap Tire Workgroup membership e-mail list as a "list serv" for dialogue among the members.
- Support the Scrap Tire Workgroup participation in various government and industry conferences and workshops.

The overall success of the Scrap Tire Workgroup will be achieved when the diversion goal and tire pile reduction goal are met.

Pending Project Descriptions

Every two years, the Rubber Manufacturers Association (RMA) publishes their Biennial Market Report, which provides various information and data on US scrap tire markets. The RMA Biennial Market Report is a compilation of information obtained by surveying state Scrap Tire Programs. Since many states opt not to complete RMA's survey forms, the Goals Committee places telephone calls and/or sends e-mails to nonresponsive states urging participation. Completion of state surveys is very important; the Goals Committee utilizes the data to measure progress toward reaching the Scrap Tire Workgroup's numerical goals.

During 2011 and 2012, the Scrap Tire Workgroup presented EPA with a draft revision of EPA's Scrap Tire Homepage. This project took many months to complete, and it included a total overhaul of the Scrap Tire Workgroup section. The Goals Committee took the lead in preparing the introduction, and Committee members were involved in all phases of the review and editing process of the full document.

The Goals Committee has taken a leading role in the planning and organizing of annual Workgroup meetings and various state scrap tire regulator meetings. Various Goals Committee member states, EPA, and other industry members have contributed funding for these events, as well.

Market Trends

Sustainability calls for policies and strategies that meet society's present needs without compromising the ability of future generations to meet their own needs. Consistent with that vision, the Scrap Tire Workgroup has endeavored to find uses for scrap tires that are sustainable.

Every other year, the RMA conducts a nation-wide survey on the scrap tire markets in all 50 States. For 2009, RMA determined that 81.9% of tires were beneficially reused in some capacity, making scrap tires the second most reused material in America.

As in the past, TDF remains the highest single use (52.8%), although its use went down compared to the past (2007). On the other hand, ground rubber made a spectacular jump of 72% (from 2007), though it is second in overall percentage at 16.8%. Civil Engineering (CE) decreased to 11.9%. All other uses were minimal (6%), while land disposal equaled 12.6%.

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2009 U.S. Scrap Tire Market Summary

Market or Disposition	2005	2007	2009
Tire-Derived Fuel	2144.64	2484.36	2084.75
Ground Rubber	552.51	789.09	1354.17
Land Disposed	590.81	593.98	653.38
Used Tires	n/a	n/a	371.25
Civil Engineering	639.99	561.56	284.92
Reclamation Projects	UNK	132.58	130.00
Exported[1]	111.99	102.08	102.10
Baled Tires/market	UNK	UNK	27.76
Electric Arc Furnace	18.88	27.14	27.10
Baled/no market	42.22	9.31	15.57
Agricultural	47.59	7.13	7.10
Punched/ Stamped	100.51	1.85	1.90
Total to Market	3616.11	4105.79	4391.05
Generated[2]	4410.73	4595.72	5170.50
% to Market/Utilized	82.0%	89.3%	84.9%
% Managed (including baled and landfilled tires)	96.3%	102.5%	97.9%

[1]RMA began tracking tires culled from scrap tire collection entering domestic used passenger and light truck used tire markets in 2009.

[2]RMA changed the basis for reporting scrap tire generated annually from state-provided data in 2005-2007 to a calculation of replacement market tires sold and vehicles scrapped in 2009.

2009 U.S. Scrap Tire Generation

Tire Class	Millions of Tires	Market %	Average Weight (lbs)
Light Duty Tires	**259.1**	**88.81%**	**22.5**
Passenger tire replacements[1]	189.50	*64.94%*	
Light truck tire replacements[1]	27.80	*9.53%*	
Tires from scrapped vehicles[2]	41.8	*14.34%*	
Commercial Tires	**32.7**	**11.19%**	**120**
Medium, wide base, heavy truck replacement tires[1]	*13.0*	*4.45%*	
Tires from scrapped trucks and buses[2]	19.7	*6.74%*	
Total scrapped tires	**291.8**	**100.0%**	**33.4**

[1]**Factbook 2010: U.S. Tire Shipment/Activity Report for Statistical Year 2009, Rubber Manufacturers Association.**

[2] **Ward's Motor Vehicle Facts and Figures, 2010. Includes the number of vehicles removed from service in the car/light truck, truck and bus categories in 2009. Assumes four tires scrapped from light duty vehicles and five tires scrapped from trucks and buses.**

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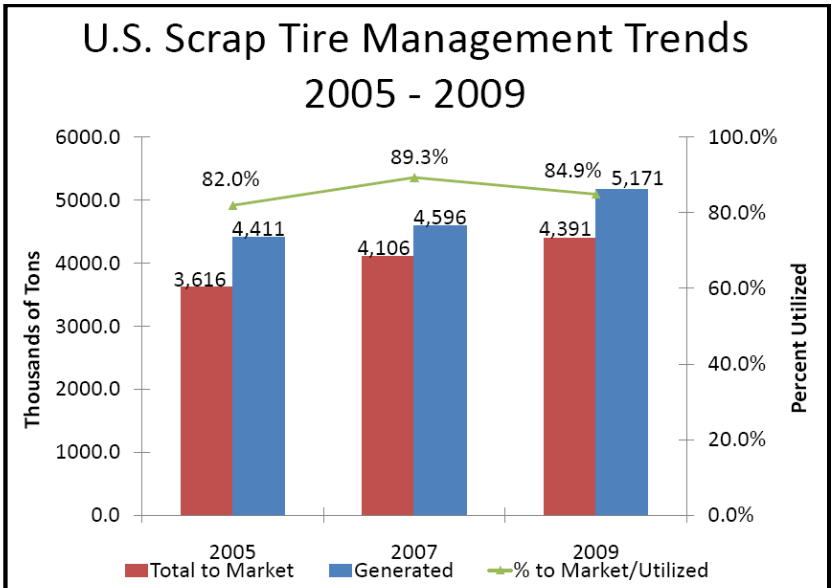
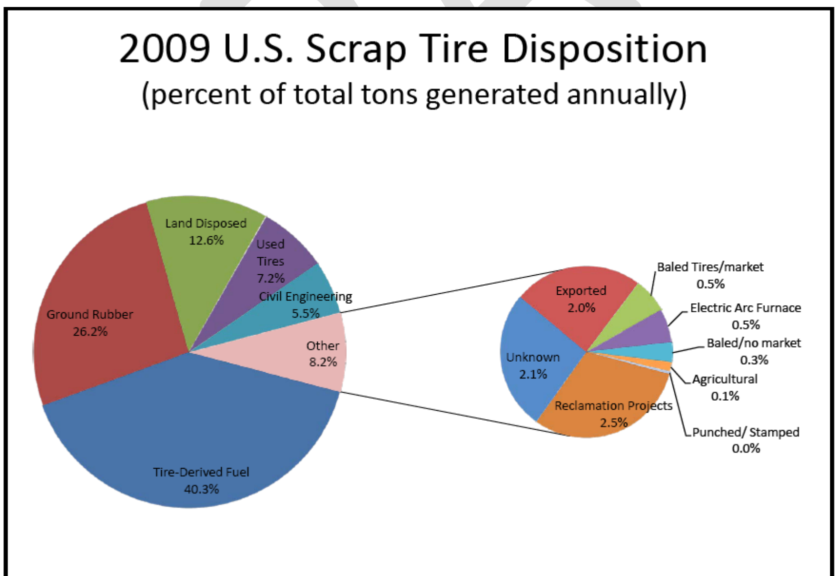


U.S. Scrap Tire Management Trends
2005 - 2009
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
Thousands of Tons
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
Percent Utilized
82.0%
89.3%
84.9%
3,616
4,411
4,106
4,596
4,391
5,171
2005
2007
2009
Total to Market
Generated
% to Market/Utilized



2009 U.S. Scrap Tire Disposition
(percent of total tons generated annually)
Land Disposed 12.6%
Used Tires 7.2%
Civil Engineering 5.5%
Ground Rubber 26.2%
Other 8.2%
Tire-Derived Fuel 40.3%
Exported 2.0%
Unknown 2.1%
Reclamation Projects 2.5%
Baled Tires/market 0.5%
Electric Arc Furnace 0.5%
Baled/no market 0.3%
Agricultural 0.1%
Punched/ Stamped 0.0%

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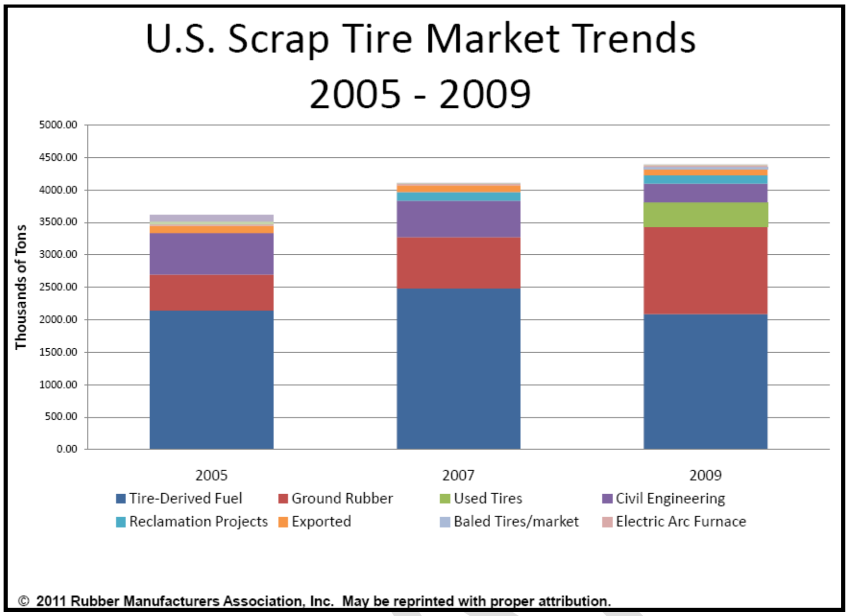

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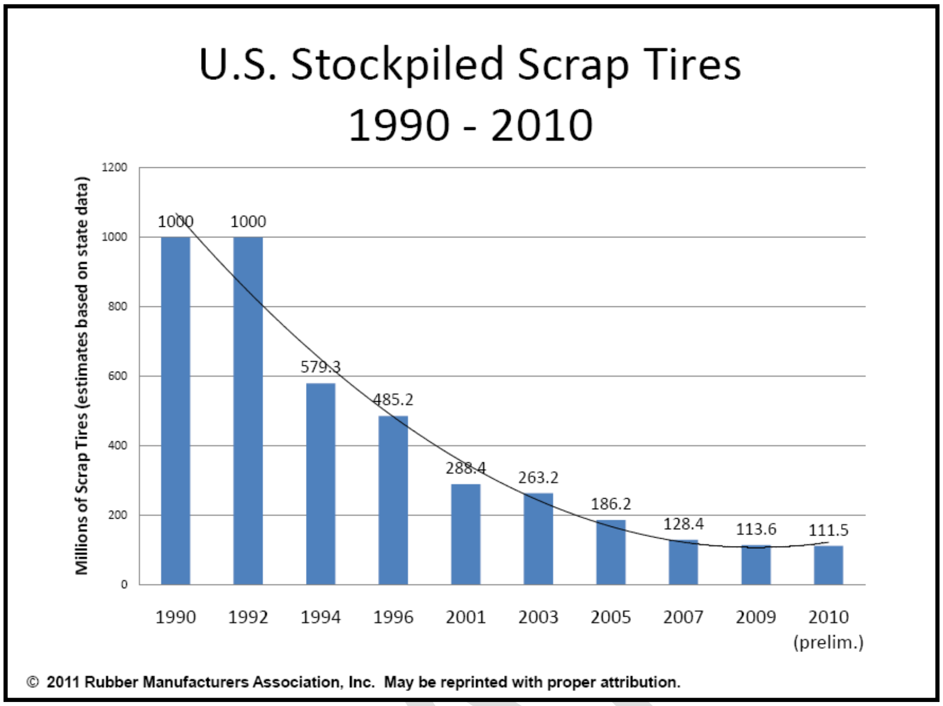
The RMA figures are just a placeholder with a better version to be provided? The problem with this one is no data is provided for each bracket
See RMA final copy

Tires in Stockpiles

Since the first estimates of 1 billion tires in piles in 1990, states, local governments and private entities have made steady progress cleaning up tire dumps all across the U.S. RMA estimates that in 2009, only 113 million tires remained in such dumps. This graph does not include the two monofills in Colorado that are permitted as "Active Operations. See the Basics Information page Landfill Disposal section for a complete explanation.

U.S. Stockpile Reduction Progress



Remediation Examples

Before | During | After

Top: Before, during and after photographs are of McMaster's Tire, Tire Remediation Project in Portage Co OH. Liberty Tire completed work in late 2004. The project removed about 1,050,024 tires at a cost of $1,565,572. Source: Harry E. Smail, Ohio Environmental **Protection Agency, Division of Materials and Waste Management Financial Assurance and Remediation Unit.**

Bottom: Before, during and after photographs are of the clean up at Morgan/Mechanicsville in St. Mary's County, Maryland. It contained approximately 121,335 tires, and cost Maryland over $1.2 million to clean it up. It was completed in 2008. (http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/StateAgencyRecycling/Documents/FY%2010%20Scrap%20Tire%20Report_FINAL.PDF)

Contact Information

Elizabeth Hoover, Goals Committee Chairwoman
Arkansas Dept. of Environmental Quality
ehoover@adeq.state.ar.us
Phone: (501) 682 – 0585
www.adeq.state.ar.us

Wastes Home

Resource Conservation Home

Common Wastes and Materials Home

Scrap Tires Home

Basic Information

Uses

Environmental Issues

Laws/Statues

Where You Live

Grants/Funding

Science/Technology

Publications

Scrap Tire Workgroup

Information Resources

Laws & Regulations

Educational Materials

Partnerships

Ground Rubber Committee

Commented [MRS21]: New web page

http://www.epa.gov/epawaste/conserve/materials/tires/workgroup/rubber.htm

Purpose

The Ground Rubber Committee of the EPA Scrap Tire Workgroup is focused on market applications for ground rubber other than rubberized asphalt which is covered by a separate committee. This includes molded and extruded products manufactured with a rubber or plastic binder or products which use the ground in loose fashion such as synthetic turf athletic fields and playgrounds.

The key to increasing ground rubber usage is providing consumers and manufacturers with technical assistance, information, market development tools and other resources.

2012 Committee Members:

Chair: Jim Gilbert, NY ESD

- Michael Blumenthal, RMA
- Toni Duggan, New Mexico Environment Dept
- Lisa Evans, Kentucky DEP
- Terry Gray, TAG Resource Recovery
- Elizabeth Hoover, Arkansas DEQ
- Denise Kennedy, DK Enterprises
- Mary Sikora, TIA, Recycling Research Institute
- John Amato, JJA Sports
- Sally French, CalRecycle
- Jonathan Levy, ISRI
- Andrew Horsman, Ontario Tire Stewardship
- Mark Schuknecht, US EPA

Ground Rubber Committee Description

The Ground Rubber Committee is composed of members representing several government regulatory and market development programs as well as a number of private sector interests. The group meets via conference call on an ad hoc basis and meets in-person annually in conjunction with a related activity such as a conference.

Ground Rubber Committee Objective

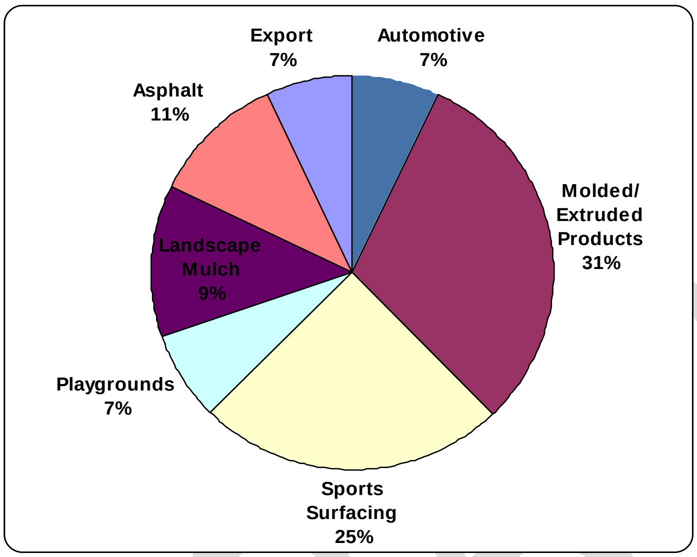
The objective of the Ground Rubber Committee is to assist and guide the ground rubber industry in accelerating its historical market growth, with full recognition that industry members themselves must buy-into and drive any accomplishments.

Market Trends

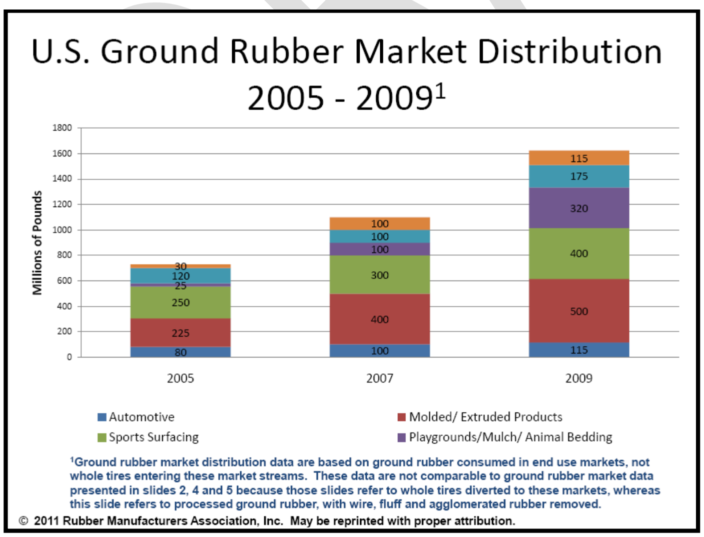
RMA reports that the market applications for ground rubber increased rapidly from 552.5 tons in 2005 to 789.1 tons in 2007 and 1,354.2 tons in 2009. This is a 145% growth over four years. A large portion of the growth is attributable to the growing acceptance of ground rubber as an asphalt additive. Ground rubber used as a raw material in manufacturing new

Commented [MRS22]: Editorial Note: Add link to the Rubberized Asphalt Committee Section products and in loose granular applications such as artificial turf infill and as playground mulch are also experiencing rapid growth.

2009 U.S. Ground Rubber Markets



(Source: Rubber Manufacturers Association Scrap Tire Market Report 2009)



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Analysis of market barriers to further growth in ground rubber applications as a growth opportunity for tire

The first barrier identified primarily relates to the use of ground rubber in athletic and playground surfaces. Concerns have been raised by a number of parties regarding whether the materials escaping from the product contributes to human health issue of users and/or the environment.

Human Health and Environmental Issues			
Barriers	**Actions to Date**	**Conclusions**	**Further Action Needed**
□ **Health Issues**: ✓ Toxicology ✓ Volatility (Fumes) ✓ Heat stress □ **Environmental Issues** ✓ Leachate ✓ Air quality □ **Safety Issues** ✓ Flammability (rate of spread) ✓ Wire	□ Several state government agencies, including the EPA, and other organizations worldwide have conducted studies on health and environmental aspects of using ground rubber in artificial turf and playground applications	□ The studies found that the concentrations of materials that made up tire crumb were below levels considered harmful either to humans or to the environment □ Some concern continues to be raised about the heat retention properties of black rubber, causing user heat stress issues □ Although the agencies have indicated that any concerns are minimal compared to other priorities, no definite statements have been made	□ Continue to respond to negative PR □ Generate more positive proactive publicity for the material properties. □ More research should be conducted on mitigating heat stress. □ Continue to conduct research as identified. □ Create definitive statements. □ Produce positive PR statements.

Commented [MRS23]: Editorial Note:
This is just a placeholder with a better version to be provided? There are three problems with it:
1.The footnote does not completely match – it has references to slides 2, 4, 5 which are provide and labeled differently else ware in the text. See Goals Committee section.
2.There are six categories in the graph: orange, light blue, purple, green, red, royal blue, but only 4 of them are defined (orange and one of the blues are missing) See RMA final copy

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Ground Rubber Marketing			
Barriers	**Actions to Date**	**Conclusions**	**Further Action Needed**
□ Very few ground rubber producers are good at marketing their products □ Ground rubber producers have very little money available for marketing □ In many cases the producer's marketing of ground rubber products amounts to undercutting competitors' prices	□ Several states have used grants programs to try to stimulate purchases of rubber playground mulch, running tracks and just about anything that can be made with ground tire rubber. □ Several states have included ground rubber products in their states' purchasing preference guidelines	□ The record on grants programs is spotty. The programs are mostly deemed a success for helping to help struggling businesses. The traditional knock that □ The ability to stimulate demand by state purchase preferences is overwhelmed by other priorities.	□ It is very difficult for government programs to be directly responsible for marketing products. □ Usually the best that can be done is to cover the downside by providing standard cross-producer information which individuals can use as the basis for marketing claims.

Quality Control			
Barriers	**Actions to Date**	**Conclusions**	**Further Action Needed**
□ Ground rubber producers still have great difficulty producing consistent product that meets user specifications □ Very few ground rubber producers have active/effective quality control programs □ Loss of existing market because producers cannot produce a consistent product.	□ Over time the marketplace has weeded out, and is continuing to weed out, operators who cannot provide consistently good products. □ Quality control programs and practices are being implemented and are responsible for much of the improvements being seen in the marketplace	□ Ground rubber committee members are participating in product standard setting initiatives such as ASTM	□ Development

Imports			
Barriers	**Actions to Date**	**Conclusions**	**Further Action Needed**
▫ Product produced from ground rubber that is imported to the U.S. from other countries ▫ Outsourcing to other countries the manufacture of products containing ground rubber	▫ Some states have state procurement policies that encourage the use of in-state generated ground rubber (See marketing barrier)	▫ Overcoming this barrier often involves international trade law and policy that will be difficult, if not impossible, to overcome.	▫ Continue to monitor.

Product-Specific Problems			
Barriers	**Actions to Date**	**Conclusions**	**Further Action Needed**
▫ Will the black rub off	▫ Black "rubbing-off" has not been reported as an issue in recent years.	▫ Believe this was in relation to processors using non-tire rubber for some product lines	▫
▫ Colorizing (health, environmental)	▫ Colorizing systems, both latex and urethane-based, meet rigorous health and environmental standards		
▫ Bugs (mulch)	▫ Bugs in rubber mulch has not surfaced as an issue in recent years		
▫ Product floating away after heavy rain (mulch)	▫ Standards for playground fall-height protection and its relationship to rubber mulch depth continue to be better understood and promoted		

Ground Rubber Committee Action Plan

▫ **National**

- The EPA, through the Scrap Tire Work Group, should be the primary champion and spearhead the effort.
- Committee members to identify and compile success stories, technical reports, available products, and marketing tools.
- Make public access to all information available through the EPA website.
- Coordinate with various partners to create cross links on the web (EPA, RMA, STC, etc. websites).
- Compile studies to address institutional barriers of each ground rubber product.
- Committee members to help identify and spearhead further studies.
- EPA and Committee members to help identify partners to co-sponsor the studies.
- Outreach through conferences

□ **States**

- Educate the public on products' merits
- Promote changes in each State's procurement processes to further encourage the use of ground rubber products

□ **Private Sector**

- Identify market opportunities and issues and bring them to the attention of the RCC committee
- Assist with research and marketing efforts

Pending Project Descriptions

The committee initially identified perceived barriers to growth of major ground rubber market segments (as summarized in the table above), then developed specific projects intended to assist the industry in overcoming these barriers.

The key to increasing ground rubber usage is providing technical assistance, information, market development tools and resources to ground rubber producers and end use markets. The objective is to assist and guide the industry in accelerating its historical market growth, with full recognition that the industry itself must drive the accomplishment.

The committee defined the following steps and specific projects for implementation:

- Compile success stories
- Compile technical reports and studies
- Encourage cooperative marketing programs
- Encourage quality control programs
    - ISO type certifications (thru association audits)
    - Training programs

Distribute Information

- Partnerships
- Conferences
- States

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Project #1: Reports and Studies

Sharing information is essential to leverage scarce public resources and effectively promote uses for ground rubber. This project will compile available technical reports, research studies, and case studies on ground rubber uses. The reports and studies will be summarized and posted on the USEPA's website.

A summary of reports, technical studies, and case studies on ground rubber uses will be categorized. The state of California may provide funding to a California-based university or contractor for this activity. Additional support may be needed for technical review of some reports. Possible sources include ISRI, RMA, and other industry associations. Success will be measured by compilation of the information into a usable form for the USEPA to post on its web site.

Project #2: Encouraging Cooperative Marketing

Businesses usually pursue their own marketing and customer education efforts. Certain industry sectors (such as sports surfacing, playground, and colored mulch applications) may benefit from pooling resources for cooperative marketing, cooperative customer education, and a consistent product "branding" message. Such cooperation may expand markets by sharing marketing expenses, providing a consistent message, and enabling businesses to focus their resources on targeted marketing efforts rather than "image building" or education efforts. A cooperative effort is not applicable for all industry sectors nor are all of the participants in any identified industry sector expected to cooperate. Cooperation does not entail sharing "trade secrets" but agreeing on a standard or specification and participating in the marketing commitment.

Immediately discuss the equestrian model with organizers and current participants to gain perspective and benefit from lessons learned. Identification of two potential industry sectors and key businesses within those sectors. Meetings and conference calls with key participants to more fully develop the specific goals and program parameters is to be schedule. Implementation is dependent on business participation.

A process and framework for a business-led cooperative marketing and customer education program for one industry sector. This should result in an increase in customer awareness and a pooling of resources for marketing efforts. Success will be measured by the implementation of a cooperative marketing and customer education program by one sector on a regional or national basis.

Project #3: Quality Control Programs

Many ground rubber producers do not produce a consistent product that meets user specifications. Unfortunately, few ground rubber producers have active/effective quality control programs. The committee will work with the Institute of Scrap Recycling Industries, Inc (ISRI) and others to develop standards by encouraging the ISRI or other industry organization to take lead by adoption of a voluntary industry standard by producers that account for a majority of the ground rubber produced in the United States. Voluntary industry standard and best practices for an effective quality control program.

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Ground Rubber Committee Accomplishments

- Sharing Reports and Studies
  - Since 2005 the Ground Rubber Committee has met via conference call and email on a regular basis to provide member a forum for discussing ground rubber industry issues and identifying strategies to resolve them.
  - Annual in-person meetings in conjunction with tire recycling conferences

- Encourage Recycled Content Sector Marketing

- Individual states, the EPA, RMA and other interested parties conducted studies identifying the benefits and limitations of using ground rubber as an infill material in synthetic turf athletic fields and in playground mulch applications. The culmination was a report from the EPA now posted on its website addressing the concerns raised by various groups.

Commented [MRS24]: Add link to Environmental Issues posting

- Quality Control Improvements
  - Several Ground Rubber Committee members worked through the ASTM International standards organization to help the tire recycling industry develop common terminology and practices for determining the qualities of ground rubber. See the definitions section of ASTM D 6270 Standard Practice for Use of Scrap Tires in Civil Engineering Applications. Also see D 5603 Standard Classification for Rubber Compounding Materials – Recycled Vulcanizate Particulate Rubber and D 5644 Standard Test Methods for Rubber Compounding Materials—Determination of Particle Size Distribution of Recycled Vulcanizate Particulate Rubber.
  - Some Ground Rubber Committee members are part of current ASTM efforts to develop specifications for using ground rubber in synthetic turf and playground applications.

Contacts

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Civil Engineering Committee

http://www.epa.gov/epawaste/conserve/materials/tires/workgroup/civil.htm

Commented [MRS25]: New web page

Purpose

Work with industry, academia, and all levels of government to identify civil engineering "champions" and provide accurate educational information to increase the usage of civil engineering applications for scrap tires.

Committee Members

Chairman: Todd Marvel, Illinois EPA

- Sergi Amirkhanian, Phoenix Industries LLC
- Michael Blumenthal, RMA
- George Gilbert, KY DEP
- Terry Gray, TAG Resource Recovery
- Jason Harrington, FHWA
- Dana Humphrey, University of Maine
- Denise Kennedy, DK Enterprises
- Blake Nelson, MN DOT
- Monte Niemi, First State Tire Recycling
- Steve Smith, EPA Region 4
- Lou Zicari, NY Center for IWM Univ. at Buffalo
- Bill Vincent, ISRI, Colt Industries
- Mark Schuknecht, US EPA

Current civil engineering (CE) applications for scrap tires are grouped into five primary categories:

- Road construction (lightweight fill over weak soils as road sub-grade and in bridge embankments, retaining wall backfill, lightweight aggregate behind bulkheads, landslide stabilization, insulation in cold climates, and as a high-permeable medium for edge drains)
- Landfill construction (leachate drainage/collection layer, surface water drainage/collection layer under landfill cap, and gas injection/collection layer under landfill cap)
- Septic field drainage medium (backfill around effluent leach field piping)
- Vibration damping layer under railroads
- Backfill for residential foundation walls

These civil engineering applications use tire derived aggregate (TDA). TDA generally consists of scrap tire chips that are 3 to 12 inches in size depending on the application specifications. The engineering properties of TDA that make it a desirable substitute for more traditional forms of aggregate include: lightweight, high permeability, low thermal conductivity, vibration damping ability, compressibility, and reduced lateral loading.

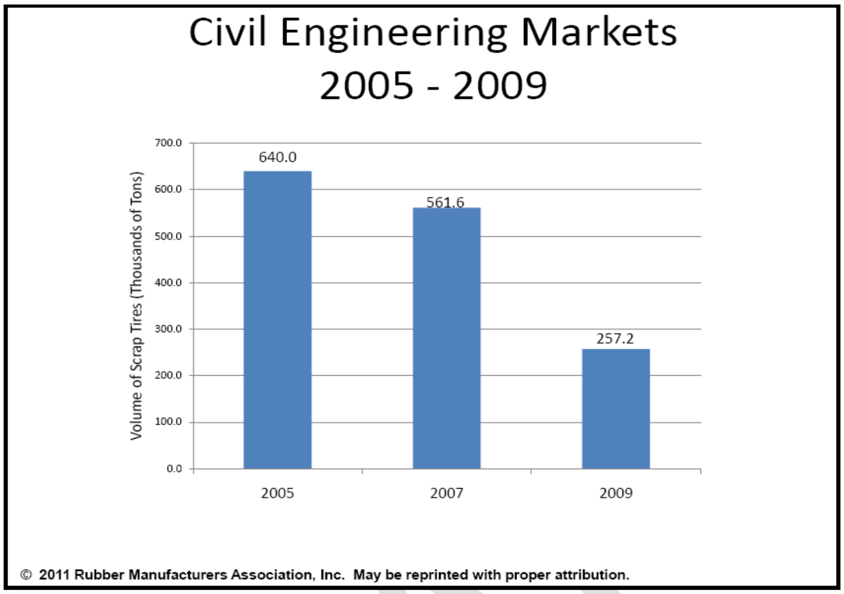
Background

It is important to continually identify, analyze, and minimize (or eliminate where possible) unnecessary barriers to CE applications for TDA. These barriers are primarily regulatory, institutional, cost-related, or perception-related in nature. The barriers identified by the CE committee are listed below.

- There is a lack of clear acceptance and approval from some state environmental and public health agencies regarding the use of TDA, due primarily to water quality and environmental toxicology concerns.
- Some states consider TDA as a solid waste, therefore subjecting the use of TDA in CE applications to the full solid waste storage and disposal requirements.
- Regulations that designate all TDA as a solid waste are largely due to the activity of past "bad actors," where states have been stuck with the cleanup bill involving the removal of shredded tire stockpiles. A major factor related to this barrier is the speculative accumulation of TDA by the scrap tire processing industry prior to the development and approval of sound specifications and regulatory approval for the application.
- Some states consider the use of TDA in CE applications as experimental. Some charge a fee ($500.00) even for small projects. These are significant barriers to the utilization of TDA in such applications.
- There is a lack of sophistication within the scrap tire processing industry in producing a product to a specification within a specified timeframe.

Market Trends

RMA reports that the number of tires diverted to civil engineering applications has decreased significantly in recent years, primarily due to the increase in tire-derived fuel consumption, especially in the cement industry. However, the use of TDA in civil engineering applications is established in a variety of uses and is no longer considered experimental, has resulted in the establishment of various ASTM engineering standards, and has been found to be safe from environmental toxicology standpoint, and will very likely represent a significant market for the use of scrap tires in the foreseeable future.



Pending Project Descriptions

Reseed NCHRP Synthesis of Practice on Use of TDA in Road Construction CE Applications. This project involves the compilation and presentation of a Synthesis proposal on the use of TDA in road construction CE applications to the National Cooperative Highway Research Program (NCHRP). A proposal was submitted to NCHRP in January 2005. However, it was not selected. This project, a joint effort between Dr. Dana Humphrey of the Univ. of Maine (Orono) and Jason Harrington of the FHWA. It involves the revision of the proposal for reseeding and selection. This project is being evaluated annually. The proposal to prepare an NCHRP synthesis, once it is revised, will be presented to NCHRP for reseeding and selection. The expected outcome is to have the proposal selected for development and publication.

Web-based Inventory: To facilitate the availability of current and historical information related to scrap tires utilized in CE applications, USEPA, with assistance from the CE Committee, should maintain a web-based inventory of links to such data in the scrap tire section of the USEPA RCC web site. Although this Committee recognizes that such information is available from various existing web-based sources (USEPA, RMA, ASTM, Univ. of Maine – Orono, Clemson University, etc.), the presence of a comprehensive inventory on

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USEPA's web site should serve as official recognition of such information from the applicable federal environmental regulatory agency. In addition, the Federal Highway Administration (FHWA), the Association of General Contractors of America (AGC), and the American Road and Transportation Builders Association (ARTBA) all maintain web-based information related to DOT projects for CE applications. Maintaining this information on these respective web sites should serve to encourage the consideration of scrap tire shreds in CE applications and to address related environmental impact concerns.

Accomplishments

Development of a CE Application DVD that Promotes the Use of TDA in CE Applications Developed and posted the Tire Derived Aggregate (TDA) in Civil Engineering Applications DVD that illustrates the legitimacy of TDA use in CE applications. This project involved the development of a DVD that was distributed by CE Committee members and other CE application champions to entities that are responsible for making decisions on the type of materials to be used in projects where TDA is a demonstrated alternative. The objective of this project was to develop a final, professional DVD that educates the viewer on the legitimate, documented uses of TDA in CE applications. (completed summer 2010) http://www.youtube.com/view_play_list?p=9BE0025147873678

Water Quality and Environmental Toxicology Summary This project involved the compilation and summarization of available water quality and environmental toxicology data involving the use of TDA both above and below the water table. The purpose is to evaluate and illustrate the environmental impact of the use of TDA in sub-grade civil engineering applications. This project was completed by students at the University of Maine (Orono) under the direction of Dr. Dana Humphrey, Dean of the Dept. of Engineering. This project, titled Field Study of Water Quality Effects of Tire Shreds Placed Below the Water Table, was completed in November 2006 and is available on-line at: http://www.rma.org/scrap_tires/scrap_tires_and_the_environment/field_study.pdf

Developed and Implemented a Template for the Compilation and Publication of a Comprehensive Compendium of Successful CE Application Involving the Use of TDA. This project involved the development and use of a template designed to be used to collect standardized, critical information on successful CE applications. The purpose is to compile a compendium of such applications, as well as create a standard publication format to facilitate the promotion of successful CE applications on various web sites (USEPA, RMA, etc.), trade magazines, and mass media organizations. The objective for this project was the compilation of a nationwide, standardized CE application compendium as well as the development and future use of example publications of CE application success stories. (completed Summer 2007) http://www.epa.gov/epawaste/conserve/materials/tires/tdastudy.pdf

Commented [MRS26]: Correct this ink

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Rubberized Asphalt Committee

Commented [MRS27]: New web page

http://www.epa.gov/epawaste/conserve/materials/tires/workgroup/asphalt.htm

Purpose

To support the expanded and appropriate use of scrap tires in rubberized asphalt mixtures.

The major objectives of this subcommittee are a) brining ideas together; b) technically helping various groups resolving legislature issues; c) education; d) helping the paving industry by providing technical information; and e) helping to bring many interested parties together.

Determine the steps that are required to, and develop ways to, encourage use. The Committee is focusing on several issues including:

- Educate the public and increase awareness at all levels about the benefits of using rubberized asphalt.
- Identify and find solutions for the perceived barriers in using rubberized asphalt.
- Identify and cultivate champions within various levels of the public sector and government agencies.

Committee Members

Chairman:
Serji Amirkhanian, Phoenix Industries LLC
Adjunct Professor, AZ State Univ.

Michael Blumenthal, RMA
Doug Carlson, Liberty Tire
Jason Harrington, FHWA
Todd Marvel, Illinois EPA
Winthrop Brown, GA DNR
Mark Belshe, RPA

Goals and Targets

- Increase the amount of crumb rubber used in asphalt by 5%.
- Success will be measured by increased use of rubberized asphalt.

Market Trends

For many years, since early 1990a, rubberized asphalt mixtures have been used in many states around the country either as an alternative mixture to polymerized asphalt or as an experimental mix. In some states (e.g., Arizona, California, Texas, Florida) the use of rubberized mixtures is viewed as a normal practice. The price of oil (binder is a by-product of oil industry), since 1990s, has increased many folds. In addition, SBS polymers (materials used to produce polymerized asphalt) have been in short supply. The price of crumb rubber is almost half of the price of binder. However, the true cost savings associated with the utilization of rubberized asphalt come from the long life cycle, decreased maintenance and in some cases use of less material. For many reasons (e.g., "Green" initiatives, acceptance of the materials by more state DOTs, new technologies in this area, etc.), it is anticipated that the use of these materials will be increased. For example, California's use of crumb rubber in asphalt mixtures had increased over 8% (California Waste Tire Market Report: 2010, California Department of Resources Recycling and Recovery June 2011; Publication # DRRR-2011-017). Many state departments of transportation are using various modified rubberized asphalt to pave their pavements (e.g., Louisiana).

Pending Project Descriptions

Project #1: Produce a comprehensive report that describes many field applications and laboratory research activities around the country by conducting library research on demonstration projects and generate a list of which states are currently using rubberized asphalt on a regular basis and report on their performance.

Tasks:

- Identify the source of funding to perform the task
- Identify the Contractor to perform the duties and
- E-mail sent to states and other parties.

Project #2: Identify perceived obstacles by listing the obstacles that users are facing and a corresponding list of suggestions showing how to overcome them. List the barriers to free market development and rubberized asphalt use.

Project #3: Identify decision makers for states and local municipalities that deal with the use of asphalt materials and update the list frequently. Determine how to promote / showcase this process by establishing a method of approaching state and local agencies to present the process in order to increase the use of these materials.

Project #4: Develop a video DVD containing many topics on rubberized asphalt including the following:

- Interviews with many experts around the world regarding the advantages of rubberized asphalt,
- Interviews with various Dept of Transportation to demonstrate their experiences,
- Interviews with different contractors around the country demonstrating their experiences with using these materials,
- The processes of producing rubberized asphalt mixtures,
- Several DVDs will be produce for various audiences including: DOT officials, politicians, local decision makers, general public, etc.
- DVDs will include topics such as a) research findings from all over the country; b) experiences of contractors with different processes; c) advantages and disadvantages of each process; d) life cycle cost analysis of these materials; e) future utilization of rubberized asphalt around the country.

Roller picture: Rubberized Project in Anderson, SC; October 2001; 9.5-mm 75-gyration mix with 10% nominal #40-mesh CRM by weight of the virgin PG 64-22 binder

Paver picture: Rubberized Project in Anderson, SC; August 2001; 9.5-mm 75-gyration mix with 10% nominal #40-mesh CRM by weight of the virgin PG 64-22 binder

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Accomplishments

- Developing the video program and interviewed many exports: Many exports around the country have been interviewed and more DOT officials and contractors are being interviewed at this point,
- Conducted Survey of all the states: A survey of all state DOTs were conducted regarding the utilization of rubberized asphalt. A summary of the survey could be obtained by contacting: Serji Amirkhanian at Serji.amirkhanian@gmail.com
- Developed a library: The process of gathering all the technical reports and research articles from researchers from around the world is ongoing.

Contacts

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Resurfacing of Interstate 15 (Las Vegas, Nevada) between Tropicana Avenue and Charleston Boulevard Monday, Sept. 19, 2011 (Source: Las Vegas Sun).

Tire Derived Fuel Committee

http://www.epa.gov/epawaste/conserve/materials/tires/workgroup/tdf.htm

Commented [MRS28]: New web page

Purpose

To support the continued sustainable use of scrap tires as a supplemental energy resource in properly permitted industrial facilities when no local or regional reuse or recycling markets exist or are slow to develop. This avoids formation of waste tire stockpiles and landfilling of this important resource.

- Be a forum for the education of the public;
- Encourage exchange of technical data and dialogue between states, EPA, facilities, trade groups, etc.
- Obtain and provide comments to EPA regarding proposed regulations and Notices;
- Facilitate use of TDF in an environmentally safe manner;
- Provide a stabilizing influence to the TDF market;
- Provide sound and unbiased data on the use of TDF as a supplementary energy source; and
- To use TDF as a part of Sustainable Material Management consistent with appropriate life cycle analyses for true environmental savings or impacts.

Tire Derived Fuel Committee Members

Chairman: George Gilbert, KY DEP

- Michael Blumenthal, RMA
- Terry Gray, TAG Resource Recovery
- Mary Hunt– EPA Region 3
- Todd Marvel, Illinois EPA
- Tyrone Wilson, Portland Cement Assoc.
- Brian Shrager, EPA OAQPS
- Keri Meyers, LA DEQ
- Mike Winek, Attorney, Pittsburgh
- Kara Steward, Washington Dept. of Ecology
- Mark Schuknecht, US EPA
-Rick Colyer, Columbus McKinnon
-Jana White SC DHEC
-Keri Meyers, LA DEQ

Determine which industries could use tire derived fuel (TDF) and develop ways to continue use until more sustainable markets are developed:

The Committee is focusing on these three industries:

Commented [MRS29]: What about Electric Arc furnaces at steel mills?

- Power Generation Industry
- Cement Plants
- Pulp and Paper Mills

Background

TDF is one of several viable alternatives to divert newly generated scrap tires from disposal in tire piles or landfills, and to avoid creating new tire piles. Disposal of scrap tires in tire piles is not an acceptable management practice because of the risks posed by tire fires, and because tire piles can provide habitats for disease vectors such as mosquitoes.

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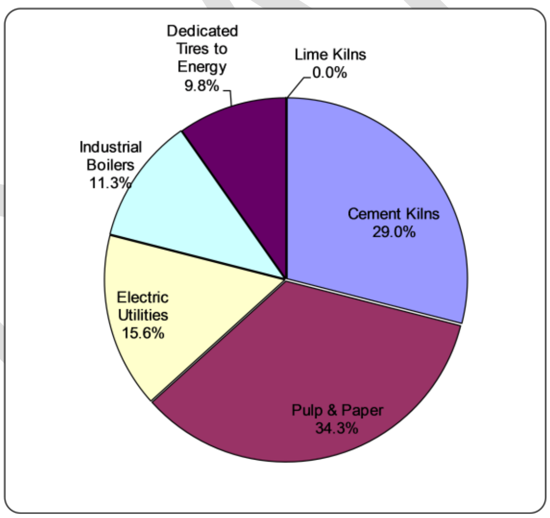
(Source: http://www.entire-engineering.de/str/en.html Tire fire in a canyon in Stanislaus County California September 1999.)

Now, as most tire piles are cleaned up, tire derived fuel has proven to be the base market for the majority of scrap tires. Once energy is recovered from a scrap tire, its characteristics that are so vital to other reuses are lost and gone forever. The challenge going forward is maintaining the energy recovery markets until these more permanent products are wanted by the general public.

Market Trends

In 2009, more than 303 million scrap tires were generated in the US. Nearly 107 million of these tires were recycled into new products, and 164 million were reused as tire-derived fuel (TDF) in various industrial facilities.

2009 Tire Derived Fuel Markets



(Source: Rubber Manufacturers Association 2009 Market Report)

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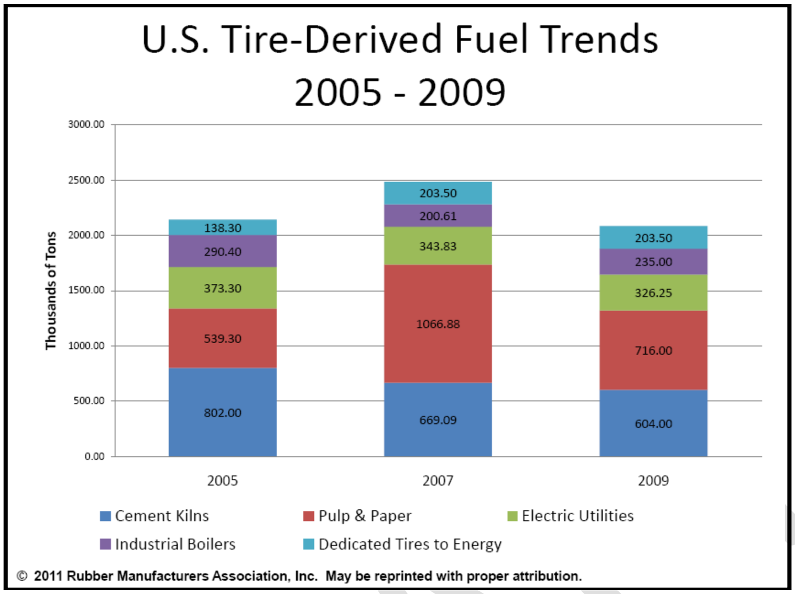

(Source: Rubber Manufacturers Association 2009 Market Report)

Tire Derived Fuel use grew from 2143 thousand tons in 2005 to 2,484 thousand tons in 2007, and then decreased to 2,185 in 2009. As a percentage of all tires generated, this was 49% in 2005, 54% in 2007 and 42% in 2009.

As EPA air pollution requirements change and more sustainable markets open around the country, TDF use is expected to decrease. Opposing this force is the high cost of energy which drives the market and diverts some civil engineering uses to TDF since more money is attained for the fuel version.

TDF will remain viable in the near future because it is tough, durable and flexible for such products as playground mulch, rubberized asphalt, tire derived aggregate, etc.

EPA issued and posted the TDF fact sheet at http://www.epa.gov/osw/conserve/materials/tires/tdf-fs.pdf

"EPA supports the highest and best practical use of scrap tires in accordance with the waste management hierarchy, in order of preference:

(Source: Portland Cement Assoc. TDF fact Sheet)

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reduce, reuse, recycle, waste-to-energy, and disposal in an appropriate facility."

"Based on over 15 years of experience with more than 80 ind

ividual facilities, EPA recognizes that the use of tire-derived fuels is a viable alternative to the use of fossil fuels. EPA testing shows that TDF has a higher BTU value than coal."

The Agency supports the responsible use of tires in Portland Cement kilns and other industrial facilities, so long as the candidate facilities:

- Have a tire storage and handling plan;
- Have secured a or all applicable state and federal environmental programs; and"
- Are in compliance with all the requirements of that permit.

Pending Projects Descriptions

- To facilitate the use of tire derived fuel when no other viable reuse markets exist in a particular region, and when it makes sense to do so because of the boiler configuration, type of pollution control train, ease to add TDF handling equipment and compatibility with the base fuel. Members of the committee can match past emission data to similar type of boilers and fuel for interested users, and provide contacts for past successful projects for air pollution control permitting, industry users and equipment providers; and provide detailed technical guidance on implementation or problem solving.

- To provide comments to EPA on proposed rules, notices of data availability and other requests for information.

Commented [MRS30]: (Source: of Photo?.........)

Accomplishments

- Submitted comments regarding the use of tire derived fuel compiled from industry, states and academia in response to the agency's promulgation of the final rule "Identification of Non-Hazardous Secondary Materials That Are Solid Wastes", 40 CFR Subpart 241, published in the March 21,2011 Federal Register.
- Submitted comments in response to "Proposed rules; Commercial and Industrial Solid Waste Incineration Units: Reconsideration and Proposed Amendments; Non- Hazardous Secondary Materials That Are Solid Waste, Reconsideration of final rule", 40 CFR Subpart 241, published in the December 23, 2011 *Federal Register*.
- Compiled emissions data from various industries into a spreadsheet to help prospective users of TDF; A list of barriers to TDF use, by state; and
- Made a list of contact phone numbers for industrial users and state agencies

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Contact

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